NHDES ALTERATION OF TERRAIN PERMIT APPLICATION

ATLANTIC WIND, LLC
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

horizons Engineering Inc.

34 SCHOOL STREET • LITTLETON, NH 03561 • PHONE 603-444-4111 • FAX 603-444-1343 • www.horizonsengineering.com

APPLICATION FOR
NHDES ALTERATION OF TERRAIN PERMIT
FOR
ATLANTIC WIND, LLC
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

NOVEMBER 2013

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No. 13828
LICENSED PROFESSIONAL ENGINEER

12/4/13

PROJECT NUMBER 13185
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Horizons Engineering, Inc.

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White River Junction, VT 05001
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* Information that is not applicable to this project is noted by N/A and has been omitted from this report

SECTION 1.0 AOT APPLICATION

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SECTION 2.0 PROJECT INFORMATION NARRATIVE

2.1 Copy of the Signed Application

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF ENVIRONMENTAL SERVICES
LAND RESOURCES MANAGEMENT
ALTERATION of TERRAIN BUREAU
29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
Phone: (603) 271-2147 Fax: (603) 271-6588
Website: http://des.nh.gov/organization/divisions/water/aot/index.htm
For Permit Status: http://www2.des.state.nh.us/OneStop/Wastewater_Engineering_Site_Specific_Query.aspx

ALTERATION OF TERRAIN PERMIT APPLICATION

Administrative Use Only	Administrative Use Only	Administrative Use Only	File Number: Check No. Amount: Initials:

1. PROJECT LOCATION

PROJECT NAME: Wild Meadows Wind Project			
ADDRESS: Wild Meadows Road			
TOWN/CITY: Alexandria / Danbury	COUNTY: Grafton / Merrimack	STATE: NH	ZIPCODE: 03222 / 03230
TAX MAP: 403, and addtn'l see attached	BLOCK:	LOT NUMBER: 14, and addtn'l – see attached	UNIT:
LOCATION COORDINATES: 935000E, 397000N	☐ LATITUDE/LONGITUDE ☐ UTM ☒ STATE PLANE		

2. APPLICANT INFORMATION (DESIRED PERMIT HOLDER)

APPLICANT NAME: Atlantic Wind, LLC	CONTACT NAME: Erik Lallum	
EMAIL: erik.lallum@iberdrolaren.com	FAX:503-796-6906	PHONE: 503-478-6361
ADDRESS: Two Radnor Corp. Center, Ste. 200, 100 Matsonford Road		
TOWN/CITY: Radnor	STATE: PA	ZIPCODE: 19087

3. PROPERTY OWNER INFORMATION (IF DIFFERENT FROM APPLICANT)

PROPERTY OWNER: H&H Investments, LLC. - Numerous owners. See attached.	CONTACT NAME: Don Hardwick	
EMAIL:	FAX:	PHONE: 603-588-6618
ADDRESS: PO Box 519		
TOWN/CITY: Antrim	STATE: NH	ZIPCODE: 03043

4. AGENT INFORMATION

ENGINEERING FIRM: Horizons Engineering, Inc.	CONTACT NAME: Arthur Colvin, PE	
EMAIL: acolvin@horizonsengineering.com	FAX: (603) 444 - 1343	PHONE: (603) 444 - 4111
ADDRESS: 34 School Street		
TOWN/CITY: Littleton	STATE: NH	ZIPCODE: 03561

5. PROJECT TYPE

☐ EXCAVATION	☒ COMMERCIAL	☐ SCHOOL	☐ AGRICULTURAL	☐ LANDFILL
☐ RESIDENTIAL	☐ GOLF COURSE	☐ MUNICIPAL	☐ LAND CONVERSION	☐ OTHER

6. BRIEF PROJECT DESCRIPTION (PLEASE DO NOT REPLY "SEE ATTACHED")
Atlantic Wind, LLC wishes to construct a 23 turbine wind facility along ridgelines in Danbury and Alexandria. The project will include construction of these turbines as well as access roads, electrical distribution lines, operations and maintenance area, and an electrical substation and interconnection station.
7. IF APPLICABLE, DESCRIBE ANY WORK STARTED PRIOR TO RECEIVING PERMIT
No work on this project has or will be started prior to receipt of the permit.
8. REQUIRED QUESTIONS (PLEASE DO NOT LEAVE FIELDS BLANK. IF NOT APPLICABLE, STATE "N/A")
A. Date a copy of the *complete* application was sent to the municipality[1]:_____. **(Attach proof of delivery)**
B. Total area of disturbance: 6,599,439 square feet
C. Additional impervious cover as a result of the project: 1,335,139 square feet (use the "-" symbol to indicate a net reduction in impervious coverage). Total impervious cover: 4,064,450 square feet within the project' watershed.
D. Total undisturbed cover: 299,363,004 square feet within the project watershed.
E. Number of lots proposed: N/A
F. Total length of roadway: 48,402 linear feet
G. Select plan type submitted: ☐ Land Conversion ☒Detailed Development ☐ Excavation, Grading, and Reclamation ☐ Steep Slope
H. Name of receiving waters: Taylor Brook, Patten Brook, Bog Brook, Wild Meadows Brook
Using NHDES's Web GIS OneStop program (http://www2.des.state.nh.us/gis/onestop/),with the Surface Water Impairment layer turned on, list the impairments identified: N/A (enter "NA" if no pollutants are listed). For more guidance see: http://des.nh.gov/organization/divisions/water/wmb/tmdl/documents/onestop_gis_wqc_ref_guide.pdf
I. ☐ This project is within ¼ mi of a designated river (**River name:**) AND I have notified the Local River Management Advisory Committee by providing them with a copy of the complete application[1], including all supporting materials, on **Month:** __ **Day:** __ **Year:** ____ **(Attach proof of delivery)** ☒ This project is **not** within ¼ mi of a designated river.
J. Name of species identified by the Natural Heritage Bureau as threatened or endangered or of concern: Medium level Fen System, Sensitive Plant Species (some interior project parcels not queried)
K. Cut volume N/A cubic feet and fill volume N/A cubic feet within the 100-year floodplain (enter "NA" if not within the floodplain)
L. Is the project within a Water Supply Intake Protection Area (WSIPA)? YES☐ NO☒ Is the project within a Groundwater Protection Area (GPA)? YES☐ NO☒ Are the well setbacks outlined in Env-Wq 1508.02 being met? YES☒ NO☐ Note: Guidance document titled "*Using DES's OneStop WebGIS to Locate Protection Areas*" is available online. For more details on the restrictions in these areas, read Chapter 3.1 in Volume 2 of the NH Stormwater Manual.

[1] In accordance with Env-Wq 1503.05 (c)(4), *provide proof* that a completed application form, checklist, plans and all other supporting materials have been sent or delivered to the governing body of each municipality in which the project is proposed. Env-Wq 1503.05 (c)(4) also requires the applicant to provide proof that a completed application form, checklist, plans and all other supporting materials have been sent or delivered to the Local River Advisory Committee, if the project is within 1/4 mi of a designated river.

8. REQUIRED QUESTIONS CONTINUED

M. Is the project a High Load area in accordance with Env-Wq 1502.26? YES☐ NO☒
If yes, specify type of high load land use or activity? ______

N. For each type of approval or permit, check "Yes" if the permit or approval type is required for your project and indicate the permit number / approval date. Indicate "Pending" if the application has been filed, but the permit has not yet been issued. Check "No" to indicate that the permit type is required, but not yet been filed with the Department. Check "N/A" if the permit or approval type is not required for your project.

1. Water Supply Approval	☐ Y	☐N	☒N/A	Permit number:	Pending	☐
2. Wetlands Permit	☒ Y	☐N	☐N/A	Permit number:	Pending	☒
3. Shoreland Permit	☐ Y	☐N	☒N/A	Permit number:	Pending	☐
4. UIC Registration	☐ Y	☐N	☒N/A	Registration date:	Pending	☐
5. Large/Small Community Well Approval	☐ Y	☐N	☒N/A	Approval letter date:	Pending	☐
6. Large Groundwater Withdrawal Permit	☐ Y	☐N	☒N/A	Permit number:	Pending	☐
7. Other:	☐ Y	☐N	☐N/A	Permit number:	Pending	☐

9. ADDITIONAL INFORMATION

A. If you have had a pre-application meeting with AoT staff, state his or her name(s): Two pre-AOT meetings have occurred with Craig Rennie. These meetings were on 9/11/2013 and 11/6/2013 *Attach a copy of the meeting minutes.*

B. Will blasting of bedrock be required? YES☒ NO☐

C. Indicate if the project will withdraw from, or directly discharge to, any of the following water sources *post-development* and, if "Yes", indicate its purpose:

1. Stream or Wetland Purpose:	YES☐ Withdrawal ☐ Discharge ☐ NO ☒
2. Man-made pond created by impounding a stream or wetland Purpose:	YES☐ Withdrawal ☐ Discharge ☐ NO ☒
3. Unlined pond dug into the water table Purpose:	YES☐ Withdrawal ☐ Discharge ☐ NO ☒

10. CHECK ALL APPLICATION ATTACHMENTS THAT APPLY (SUBMIT WITH APPLICATION IN ORDER LISTED)

LOOSE:

☒ Signed application form: des.nh.gov/organization/divisions/water/aot (with attached proof(s) of delivery)
☒ Check for the application fee: des.nh.gov/organization/divisions/water/aot/fees.htm
☒ Color copy of a USGS map with the property boundaries outlined (1" = 2,000' scale)
☒ A copy of the pre-application meeting minutes, if you had a pre-application meeting with AoT staff.

BIND IN A REPORT IN THE FOLLOWING ORDER:

☒ Copy of the signed application form & application checklist (des.nh.gov/organization/divisions/water/aot/index.htm)
☒ Copy of the check
☒ Copy of the USGS map with the property boundaries outlined (1" = 2,000' scale)
☒ Narrative of the project with a summary table of the peak discharge rate for the off-site discharge points
☒ Web GIS printout with the "Surface Water Impairments" layer turned on - www2.des.state.nh.us/gis/onestop/
☒ Web GIS printouts with the AoT screening layers turned on - www2.des.state.nh.us/gis/onestop/
☒ NHB letter using DataCheck Tool – www.nhdfl.org/about-forests-and-lands/bureaus/natural-heritage-bureau/
☒ The Web Soil Survey Map with project's watershed outlined – websoilsurvey.nrcs.usda.gov
☒ Aerial photograph (1" = 2,000' scale with the site boundaries outlined)
☒ Photographs representative of the site
☒ Groundwater Recharge Volume calculations (one worksheet for each permit application): des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls
☒ BMP worksheets (one worksheet for each treatment system): des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls

10. CHECK ALL APPLICATION ATTACHMENTS THAT APPLY (SUBMIT WITH APPLICATION IN ORDER LISTED)

☒ Drainage analysis, stamped by a professional engineer (see Application Checklist for details)
☒ Riprap apron or other energy dissipation or stability calculations
☒ Site Specific Soil Survey report, stamped and with a certification note prepared by the soil scientist that the survey was done in accordance with the Site Specific Soil Mapping standards, *Site-Specific Soil Mapping Standards for NH & VT, SSSNNE Special Publication No. 3*.
☒ Infiltration Feasibility Report (example online)
☐ Registration and Notification Form for Storm Water Infiltration to Groundwater (UIC Registration-for underground systems only, including drywells and trenches): (http://des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge) *N/A*
☒ Inspection and maintenance manual with, if applicable, long term maintenance agreements
☐ Source control plan *N/A*

PLANS:

☒ One set of design plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details)
☒ Pre & post-development color coded soil plans on 11" x 17" (see Application Checklist for details)
☒ Pre & post-development drainage area plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details)

100-YEAR FLOODPLAIN REPORT:

☐ All information required in Env-Wq 1503.09, submitted as a separate report. *N/A*

☐ **REVIEW APPLICATION FOR COMPLETENESS & CONFIRM INFORMATION LISTED ON THE APPLICATION IS INCLUDED WITH SUBMITTAL.**

11. REQUIRED SIGNATURES		
☒ APPLICANT OR ☐ AGENT: SIGNATURE: [signature]	PRINT NAME LEGIBLY: Erik Lallum	DATE: 11/18/2013
OWNER OR OWNER'S AGENT: (IF DIFFERENT FROM APPLICANT) SIGNATURE:	PRINT NAME LEGIBLY:	DATE:
By initialing here, I understand that in accordance with Env-Wq 1503.20(e), within one week after permit approval, the applicant shall submit a copy of all approved documents to the department in PDF format on a CD.		____

Town	Tax Map	Lot #	Book/Page	Owner Name	Address
Alexandria	417	43	1444/51	Ronald L. & Donna J. Olszak	717 Mayhew Turnpike, Bridgewater NH 03222
Alexandria	417	13	3891/213	Stephen Garron & Paula Carter	425 Raymond Road, Chester NH
Alexandria	417	8	940/399	Mike Corliss	334 Mount Cardigan Road, Alexandria NH 03222
Alexandria	417	4	1770/314	Nelson R. Shaller	506 Bayshore Drive, Osprey FL 34229-9580
Alexandria	414	144	2545/503	Michael B. Oeschger	380 Lakeview Heights, Alexandria NH 03222
Alexandria	415	5	3727/990 & 999	H & H Investments, LLC	PO Box 519, Antrim NH 03043
Danbury	403	25	3727/999	H & H Investments, LLC	PO Box 519, Antrim NH 03043
Danbury	403	20	2910/1262	H & H Investments, LLC	PO Box 519, Antrim NH 03043
Danbury	403	19	2910/1262	H & H Investments, LLC	PO Box 519, Antrim NH 03043
Danbury	401	1	2910/1262	H & H Investments, LLC	PO Box 519, Antrim NH 03043
Danbury	403	9	2370/1859	Monique Jome Ricker & Michelle Jome	67 Isinglass Lane, Chester NH 03036
Danbury	403	18	2910-1262	H & H Investments, LLC	PO Box 519, Antrim NH 03043

LEASE DOCUMENTATION

Doc#: 739343
Book: 3139 Pages: 0691 - 0702
06/26/2009 1:11PM

RETURN TO:
ORR & RENO, P.A.
1 EAGLE SQUARE
CONCORD, NH 03301

COPY

55.34
2

NOTICE OF WIND ENERGY LEASE AGREEMENT

NOTICE IS HEREBY GIVEN of a certain Wind Energy Lease Agreement by and between the parties identified in this Notice, of property owned by **H & H Investments, LLC** located in the Towns of Alexandria, Grafton and Orange in Grafton County and in the Town of Danbury in Merrimack County, as follows:

LESSORS: **H & H Investments, LLC**
P.O. Box 129
Francestown, New Hampshire 03403

LESSEE: **Iberdrola Renewables USA, Ltd.**
201 King of Prussia Road, Suite 500
Radnor, PA 19087

PREMISES: An exclusive lease to the use of a portion of the Landlord's land and improvements located in the Towns of Alexandria, Danbury, Grafton and Orange, in the counties of Grafton and Merrimack, New Hampshire, described in that certain Fiduciary Deed from Marilyn F. Serra, sole Trustee of the Declaration of Trust of Charles F. Trumpetto dated February 6, 2000, as amended, to H & H Investments, LLC, which deed is dated June 28, 2006 and recorded in the Merrimack County Registry of Deeds at Book 2910, Page 1262 and in the Grafton County Registry of Deeds at Book 3304, Page 183, said premises further identified on EXHIBIT A attached hereto.

TERM: The Development Period of the Lease shall be five (5) years with a renewal term of 2 years. The Extended Term of the Lease is twenty-five (25) years beginning on the Commencement of Construction as defined in the Lease, with two (2) renewals terms of ten (10) years each.

LT1-2-739343-1

LT2-3139-691-12

LESSORS:

H & H INVESTMENTS, LLC

By: Donald H Hardwick Sr member
Donald H. Hardwick, Sr., Member
Duly authorized

By: T Hardwick Member
Teresa Hardwick, Member
Duly authorized

STATE OF NEW HAMPSHIRE
COUNTY OF HILLSBOROUGH

The foregoing instrument was acknowledged before me this 2nd day of JUNE 2009, by Donald H. Hardwick, Sr., a duly authorized Member of H & H Investments, LLC, a New Hampshire limited liability company, on behalf of the said company.

MARLENE MOSHER PAULSEN STATE OF NEW HAMPSHIRE NOTARY PUBLIC - MY - COMMISSION EXPIRES MARCH 26, 2013

Marlene Mosher Paulsen
Notary Public/Justice of the Peace
Print Name: MARLENE MOSHER PAULSEN
My Commission Expires: 03/26/2013

STATE OF NEW HAMPSHIRE
COUNTY OF HILLSBOROUGH

The foregoing instrument was acknowledged before me this 2nd day of JUNE 2009, by Teresa Hardwick, a duly authorized Member of H & H Investments, LLC, a New Hampshire limited liability company, on behalf of the said company.

Marlene Mosher Paulsen
Notary Public/Justice of the Peace
Print Name: MARLENE MOSHER PAULSEN
My Commission Expires: 03/26/2013

MARLENE MOSHER PAULSEN STATE OF NEW HAMPSHIRE NOTARY PUBLIC - MY - COMMISSION EXPIRES MARCH 26, 2013

LESSEE:

IBERDROLA RENEWABLES USA, LTD.

LEGAL

By: [signature]
Name: David C. Shadle
Title: Authorized Representative
Duly authorized

By: [signature]
Name: Trevor Mihalik
Title: Authorized Representative
Duly authorized

COMMONWEALTH/STATE OF Pennsylvania
COUNTY OF Delaware

The foregoing instrument was acknowledged before me this 8th day of June 2009, by David Shadle, a duly authorized Representative of Iberdrola Renewable Energies USA, a Delaware corporation, on behalf of the said corporation.

NOTARIAL SEAL
MARIA ROJAS
Notary Public
RADNOR TWP. DELAWARE COUNTY
My Commission Expires Nov 9, 2011

Notary Public/Justice of the Peace
Print Name: Maria Rojas
My Commission Expires: 11/9/11

COMMONWEALTH/STATE OF Oregon
COUNTY OF Multnomah

The foregoing instrument was acknowledged before me this 10th day of June 2009, by Trevor Mihalik, a duly authorized representative of Iberdrola Renewables USA, Ltd., a Delaware corporation, on behalf of the said corporation.

OFFICIAL SEAL
KATE O'CONNELL
NOTARY PUBLIC - OREGON
COMMISSION NO. 414502
MY COMMISSION EXPIRES FEB 21, 2011

Kate O'Connell
Notary Public/Justice of the Peace
Print Name: Kate O'Connell
My Commission Expires: 02/21/2011

EXHIBIT A

TO
NOTICE OF WIND FARM LEASE AGREEMENT
BETWEEN
H&H INVESTMENTS, LLC
AND
IBERDROLA RENEWABLES USA, LTD.

DESCRIPTION OF PROPERTY

The Property is the land and improvements, together with all rights appurtenant thereto as described in the Lease, located in the Towns of Grafton, Danbury, Orange and Alexandria, New Hampshire described in that certain Fiduciary Deed from Marilyn F. Serra, sole Trustee of the Declaration of Trust of Charles F. Trumpetto dated February 6, 2000, as amended, to H&H Investments, LLC, which deed is dated June 28, 2006 and recorded in the Merrimack County Registry of Deeds at Book 2910, Page 1262 and the Grafton County Registry of Deeds at Book 3304, Page 183, and is described as follows:

"<u>Picard Lot</u>"

A certain tract of land, with the buildings thereon, situated in the "Wild Meadows" section of the Town of Grafton, Grafton County, State of New Hampshire, bounded and described as follows:

Southerly by the highway; westerly by land formerly owned by Daniel B. Smith and John Tinkham; northerly by land formerly known as the Williams Place; and easterly by land formerly owned by the heirs of Greeley Sulloway.

Excepting and reserving, to the extent that the same still exists, a certain right-of-way or right to a certain lane or cow path, over and across the northwesterly corner of the premises heretofore described.

"<u>Brailey Lot</u>"

Two certain tracts of land with the buildings thereon situated in Alexandria, Grafton County, State of New Hampshire, and bounded and described as follows, to wit:

<u>Tract 1</u>.

Beginning at a stone and iron stake at the Northwest corner of the within described tract, on the Easterly side of the highway leading from Grafton to Alexandria Four Corners, so-called, and on line of land of Edgar (Ned) Haynes; thence running Southeasterly on line of land of said Haynes two hundred twenty-one (221) feet to an iron stake on the Northerly line of the second tract herein described; thence Westerly along said second tract one hundred ninety-two (192) feet to the highway; thence Northerly along said highway seventy-nine (79) feet to the point of beginning. Meaning hereby to describe a triangular piece of land.

Tract 2.

Beginning at the Southwest corner of the within-described tract, on the Easterly side of the highway leading from Grafton to Alexandria Four Corners and on the Grafton-Alexandria Town Line, said Town Line also marking line of land formerly of Alfred Williams and now of the said Charles F. Trumpetto; thence running Northerly along said highway to the Southwest corner of the first tract herein described; thence Easterly along said first tract, and continuing on the same course along land of Edgar (Ned) Haynes to a maple tree standing in an old wire fence at the corner of land of said Haynes, land formerly of one Hodgdon, now of the Sulloway Heirs, and land formerly of Alfred Williams, subsequently of Charles F. Trumpetto; thence Southwesterly along land formerly of said Williams, subsequently of Trumpetto, to the Grafton-Alexandria Town Line; thence Westerly along said Town Line by land of said Trumpetto to the point of beginning. Excepting from said tract a parcel in the Southwest corner fronting 143 feet on the highway and 250 feet on the Town Line, sold to Ernest Gilman by deed recorded Lib. 882, Fol. 412.

"Danise Lots A"

The following described tracts of land with any improvements thereon in the Town of Alexandria in the County of Grafton, bounded and described as follows, to wit:

Beginning at the Southwesterly corner of lot 9; thence on the head or cross line of said lot to the Southerly corner of said lot, being 165 rods; thence North 13 Degrees West 28 rods on the side line of said lot; thence turning and running about 140 rods to strike a beech tree standing on the Westerly side of said lot 128 rods from the Southwesterly corner of said lot; thence South 13 degrees East on said westerly line to the said Southwesterly corner of said lot, being the bound begun at, excepting and reserving that part of said premises which was deeded to Isaac Bailey.

"Robbins Lots"

TRACTS IN GRAFTON

Certain tracts or parcels of land with any improvements thereon situated in Grafton in the County of Grafton and State of New Hampshire, bounded and described as follows:

TRACT #1: Bounded easterly by Danbury Town line; southerly and westerly by Wild Meadow Pond and land formerly owned by John Tinkham; westerly and northerly by the highway to the easterly line of Nicanor Heath place, so-called; northwesterly by land formerly owned by Nicanor Heath; and northerly by Williams place, so-called, and land formerly of John Tinkham to the Danbury Town line.

TRACT #2: Also another parcel or tract of land known as cow pasture and big woods, bounded and described as follows:

Beginning at the northeast corner, northerly by land formerly owned by D. B. Smith; westerly by land formerly owned by D. B. Smith and Greeley Sulloway Heirs and so-called Smiley lot; southerly by Putney place, so-called, and Dan Peters land, so-called; easterly by Dan Peters land, George Grant, and John Tinkham land to starting point.

TRACT #3: Also another parcel or tract of land known as Mountain Pasture, bounded and described as follows:

Beginning at northeast corner, easterly by land owned by Sulloway Heirs; southerly and westerly by Smiley lot; westerly by old highway; northerly by land formerly owned by D. B. Smith to first mentioned bound.

Excepting and reserving from Tract #2 described above that small portion thereof which was conveyed by G. Wesley Sulloway to Charles Swenson, et als, by deed dated May 14, 1954, and recorded in the Grafton County Registry of Deeds, Book 851, Page 264, to which deed reference is made for a more particular description of the premises hereby excepted and reserved.

TRACTS IN GRAFTON AND ALEXANDRIA

Certain parcels of land, together with all buildings thereon standing, situate in the Town of Grafton and Alexandria in the State of New Hampshire, bounded and described as follows:

Parcel 1. In the Town of Grafton, bounded on the North by land now or formerly of Randolph Lucas; on the East by land owned formerly by Sybil Smith and Daniel B. Smith; on the South by land formerly owned by James R. Smiley and Martin M. Powers; on the West by land owned now or formerly by Randolph Lucas, being all and the same premises conveyed to Gilbert W. Sulloway by the Town of Grafton by its deed dated February 16, 1942, and recorded in Book 704, Page 280.

Parcel 2. In the Towns of Grafton and Alexandria, being all and the same premises described in deed of Winnifred S. Gray, Gdn., to Gilbert W. Sulloway, under date of April 30, 1930, and recorded in Book 620, Page 226. See also deed of Gilbert W. Sulloway to Lucette L. Sulloway of an undivided one-half interest, recorded in Book 639, Page 585.

Parcel 3. In the Towns of Alexandria and Grafton, being described as two parcels, one being the northerly half of a fifty (50) acre lot in the Town of Alexandria, and the second parcel containing about one hundred (100) acres in the Town of Grafton, and being all and the same premises described in deed of Alfred J. Kidder to G. Wesley Sulloway, dated August 18, 1941, and recorded in Book 700, Page 177.

Parcel 4. In the Town of Grafton, being all and the same premises described in a Warranty Deed from Josephine M. Tinkham, widow of John W. Tinkham, and Anna G. Tinkham, et al. children and heirs-at-law of said John W. Tinkham to Gilbert W. Sulloway, dated June 12, 1917, and recorded in Book 523, Page 477, to which deed reference is hereby made and had. See also deed of Gilbert W. Sulloway to Lucette L. Sulloway of an undivided one-half interest, recorded in Book 639, Page 585.

Parcel 5. In the Town of Alexandria, being all and the same premises described in deed from the Town of Alexandria to G. W. Sulloway, dated January 31, 1940, and recorded in Book 688, Page 333.

Parcel 6. In the Town of Grafton, bounded as follows:

Northerly by land now or formerly of George Grant; easterly by land formerly owned by Sybil Smith; southerly by land formerly owned by Sybil Smith and land formerly owned by John Tinkham; westerly by land formerly owned by Daniel B. Smith, known as the Kemp land.

Excepting and reserving, however, from this conveyance the premises conveyed by said Sterling to Raymond W. Martin by deed dated April 25, 1956, and recorded in Grafton County Registry of Deeds, Book 879, Page 378, bounded and described as follows:

"A certain tract of land with buildings thereon, situated in the Town of Grafton, County of Grafton and State of New Hampshire, and bounded and described as follows, to wit:

Beginning at the brook and running in a northwesterly direction across the highway, along the stone wall to an iron pin in the wall; thence in a southeasterly direction along a stone wall to a yellow birch tree in the end of wall by the brook; thence in a southerly direction along the brook, crossing the highway to the first mentioned bound."

Also the rights to the well of the Dan Smith property, excepted and reserved from the aforementioned deed to Martin to the extent they remain in existence.

Also excepting and reserving from this conveyance the premises previously sold by Edward C. Sterling to Marie E. Landry, bounded and described approximately as follows:

(For a more particular description, see deed in Book 913, Page 239.) A certain tract of land with the buildings thereon, situate in Grafton, County of Grafton and State of New Hampshire, bounded and described as follows, to wit:

Located on the westerly side of the highway leading from East Grafton to Alexandria and known as the Wild Meadows Road. Beginning at an iron pin at the side of said highway thence running northerly about twelve hundred feet (1200') to another iron pin; thence westerly at a right angle to a third iron pin; thence southerly along a line parallel to the said highway, or roughly so, to a fourth iron pin; thence easterly at a right angle to the point of beginning.

TRACTS IN ORANGE

A certain tract of land, together with the buildings thereon, located in the Town of Orange, County of Grafton and State of New Hampshire, bounded and described as follows:

Commencing at the northerly corner at stake and stone; thence southerly by land now or formerly of Joseph French and one Nelson Gifford to stake and stones; thence easterly by land now or formerly of Sleeper Stevens to stake and stones; thence southerly by said Sleeper Stevens land to stake and stone; thence northerly by land now or formerly of Nelson Gifford and John Bullock to stake and stone; thence northerly by said John Bullock's land to Alexandria's new town line; thence northerly by said Alexandria's new town line to the Gore lot line; thence westerly by the said Gore lot line to point begun at. Being the property formerly owned by Thomas F. Brown and conveyed by will of Thomas F. Brown and heirs.

Also another parcel of land in said Orange, bounded and described as follows:

Commencing at the stake and stones which is the point of beginning of the parcel above described and running westerly by land now or formerly of Joseph French about 160 rods to a stake and stones; thence northerly by land now or formerly owned by William Chellis to stake and stones; thence easterly to a pile of stones at the top of the mountain; thence southerly by land now or formerly owned by Eugene Moore to the point begun at.

Excepting and reserving, however, that portion of the above-described premises estimated to contain one acre, more or less, conveyed by said Sulloways to Alfred B. Therrien, et als, by deed recorded December 3, 1954 at Vol. 857, Page 262, to which reference is made for a more particular description of said excepted portion.

"Brownell Lots"

Tract #3

Certain tracts or parcels of land situate in Alexandria, County of Grafton, and State of New Hampshire, bounded and described as follows:

A certain tract of land situated in said Alexandria bounded on the east by land now or formerly of Samuel A. Patten running to Danbury Corner; on the north by the Washburn Road, so-called, on the west by land now or formerly of S. Scott Patten; on the south running from Danbury Corner parallel with the Washburn Road.

Also a certain other tract of land situate in said Alexandria and bounded and described as follows:

A certain other tract of land on the southerly side of Washburn Road, so-called, and bounded and described as follows:

Northerly by the Washburn Road; easterly by the westerly line of land now or formerly of the General Electric Company, formerly George D. Patten; southerly by land formerly of Jonas Patten formerly known as the Place Farm; and westerly by land now or formerly of Amos Blake, formerly Samuel A. Patten, being the same land conveyed in two tracts one by John and Lovina Patten to Nellie Patten, January 11, 1881. The other by said Lovina Patten, George E. Patten and Mary A. Clough to Hadlet B. Patten, August 21, 1882.

Also a certain other tract of land situated in said Alexandria, bounded and described as follows:

Beginning at the northeast corner of land formerly of Amos A. Blake at the Washburn Road, so-called; thence southerly by said Blake land to land of Edward Blake; thence southwesterly to a stone monument at the town line between Alexandria and Danbury; thence northerly to said Washburn Road; thence easterly by said Road to the bound begun at.

There is excepted and reserved out of the above-described tracts of land the following two described parcels of land:

EXCEPTION NO. 1

A certain tract or parcel of land situated on the southerly side of Washburn Road, so-called, in Alexandria, County of Grafton, and State of New Hampshire, bounded and described as follows:

Beginning at a stake in the ground which is situated 180 feet, more or less, easterly of a "line" tree, blazed; and running thence in an easterly direction along the southerly side of said Washburn Road 400 feet, more or less, to a stake in the ground at other land of Stanley W. Fenerty; thence turning at an internal angle of 55° and running a southwesterly direction approximately 1000 feet to a stone post, which stone post marks the division line between Merrimack County and Grafton County, thence running along other land of Stanley W. Fenerty in a northwesterly direction a distance of approximately 850 feet to the post driven in the ground at the point of beginning.

Meaning and intending hereby to exclude a triangular strip of land which said strip is a part of the premises contained in the first tract of land described in deed of Fred C. Tobey to Stanley W. Fenerty dated April 30, 1959 and recorded in Book 927, Page 143 of Grafton County Registry of Deeds.

Said Exception No. 1 having been conveyed by Stanley W. Fenerty to Ronald A. Davis and Barbara W. Davis by deed dated December, 1966.

EXCEPTION NO. 2

Also a certain tract or parcel of land situated on the southerly side of Washburn Road, so-called, in said Alexandria, bounded and described as follows:

Beginning at the northeasterly corner of land of Ronald and Barbara Davis, above referred to, and at the northwesterly corner of the parcel herein conveyed and running thence in an easterly direction along the southerly side of Washburn Road, so-called, a distance of 100 feet, more or less, to a stake; thence in a southwesterly direction along land conveyed to Wilmer L. Brownell, et ux, to the northerly shore of Patten Brook, so-called; thence in a westerly direction along said Patten Brook 100 feet, more or less, to land of Ronald and Barbara Davis; thence in a northeasterly direction approximately 400 feet, more or less, along said Davis land to the point of beginning.

Meaning and intending hereby to exclude a portion of the premises acquired by Stanley W. Fenerty by Deed of Fred C. Tobey, Jr. dated April 30, 1959 and recorded in Grafton County Records, Book 927, Page 143.

EXCEPTING AND RESERVING therefrom a tract of 25 acres, more or less, conveyed by said Brownells to Robert G. Taylor and Marianna E. Taylor by deeds dated October 9, 1967 and recorded in the Grafton County Registry of Deeds, Book 1069, Page 302, to which reference is made for a more particular description.

Tract #4

A certain tract or parcel of land situated in the Town of Alexandria, in the County of Grafton and State of New Hampshire, bounded and described as follows, to wit:

Beginning at the south corner of the tract on the Danbury Town Line; thence northerly on said Danbury line eighty-five (85) rods to a stake and stones; thence south 65° east to a stake and stone standing on the easterly line of Jacob Patton land, now or formerly; thence southerly to bound begun at.

Also conveying as an appurtenance to the "Brownell Lots" a right-of-way by foot or with vehicle for purposes of ingress and egress over the Dicey Lot, so-called, from the Washburn Road, so-called.

EXCEPTING from the aforementioned "Brownell Lots" located in Alexandria, the following:

1) All of Tax Map 410, Lot 16-2, being a ten (10) acre lot, more or less, located at 1165 Washburn Road, Alexandria, New Hampshire; and

2) All of Tax Map 21, Lot 21-1, being a 7.1 acre lot, more or less situated on Washburn Road, Alexandria, New Hampshire.

"Robbins Lots"

TRACTS IN DANBURY

Certain tracts or parcels of land with any improvements thereon situated in Danbury in the County of Merrimack and State of New Hampshire, bounded and described as follows:

TRACT #1: Commencing at the Town line between Danbury and Grafton at the corner of land now or formerly of one Sulloway; thence northerly by said Town line to land now or formerly owned by Dexter Perkins; thence southerly by land now or formerly of said Perkins to the range line; thence southerly by the range line to land now or formerly owned by C. A. and G. M. Sulloway; thence northerly to the first mentioned bound, said premises being known as the old Tinkham place.

Reference is made to the deed from Florence E. Barrett to G. Wesley Sulloway dated August 23, 1957, duly recorded.

TRACT #2: Containing by estimate thirty acres, more or less, and bounded and described as follows: Bounded northerly and easterly by land supposed to be owned now or formerly by George W. Sawing of Grafton; southerly by the Hale Mountain pasture, so-called, and westerly by the highway leading to the Hopper, so called, in said Danbury.

TRACT #3: Commencing at a stake and stones at the North corner of said lot on the Grafton Town Line; thence South on the Grafton Town Line to land now or formerly owned by Sulloway Heirs; thence southeasterly on land of Sulloway Heirs to the old highway; thence northerly on said highway to the Tinkham land, so-called; thence northwesterly on said Tinkham land to the first mentioned bound.

TRACT #4: Bounded westerly by land now or formerly of Cyrus A. and the heirs of Gilbert M. Sulloway; northerly and easterly by land now or formerly of Cyrus A. Sulloway and the heirs of Gilbert M. Sulloway and W. Cornell; easterly by land now or formerly of said Cornell and land formerly of John C. Pillsbury; southerly and westerly by land formerly of said Pillsbury and land now or formerly of George S. Tenney, the premises known as the Eastman Place.

TRACT #5: Westerly by the Grafton Town line; thence northerly by the land of the Sulloway heirs to the Eastman Road, so-called; thence by said Eastman Road to land formerly owned by John W. Pillsbury; southerly and westerly by land now or formerly owned by Lewis M. Bean to point of beginning.

Reserving the Town Highway through the above-described premises formerly called the Hopper Road. Also reserving a mining right in the Sanborn Pasture, so-called.

TRACT #6: Westerly by the Grafton Town Line; southerly by land formerly owned by William H. Burleigh and land formerly owned by Lucien Follansbee; easterly and northerly by said Follansbee's land and land now or formerly owned by I. B. Sargent, Peter Kimball and Nicanor Heath.

"Brownell Lots"

Tract #1

Certain tracts or parcels of land situated in Danbury, County of Merrimack, State of New Hampshire and being Lot #10 and Lot #46 as said lots are shown and laid out on the original lay-out or plan of the Town of Danbury.

Tract #2

A certain tract of land situated in said Danbury, bounded and described as follows, to wit:

Commencing at the southeast corner of Lot No. 46, thence northerly on the east side line of said Lot No. 46 about forty (40) rods to a corner at stake and stones; thence westerly about eighty (80) rods on a straight line to a stake and stones standing on the west line of said lot and parallel with the east side line about forty (40) rods to the southerly line of said Lot No. 46; thence easterly along the south line of said lot eighty (80) rods (said south line supposed to be the range line) to the point of beginning.

Also all of the mineral or inning rights appurtenant to a certain tract of land situated in said Danbury, bounded and described as follows, to wit:

Easterly and northerly by the Alexandria Town Line, westerly land of Dan Braley and Catherine Braley; and southerly by the Rolf Lot, so-called; being known as the I. H. Bailey homestead and being the easterly half of Lot #10. Containing one hundred acres.

Reference is made to deed of Standard Mica to Errol Perkins dated February 19, 1914 and entered in Book 416, Page 133 of Merrimack County Records. Said mining rights were taken by said Town of Danbury for nonpayment of taxes owed by said Standard Mica Company for the years 1915, 1916, 1917 and 1918.

Also conveying as an appurtenance to the "Brownell Lots" a right-of-way by foot or with vehicle for purposes of ingress and egress over the Dicey Lot, so-called, from the Washburn Road, so-called.

For purposes of further clarification, Landowner and Lessee have attached a map as part of Exhibit A to the Lease showing the Property. In addition, the Landowner and Lessee have attached a map as part of Exhibit A showing the "no-build" area near Grants Pond in which Lessee shall not build any improvements.

Based upon the records available to them as of the date of the Lease, Landowner and Lessee have estimated that the portion of the Property which will be subject to the Lease upon the completion of the Windpower Facilities is comprised of that land commonly known as the following tax lots:

Town	Tax Map/Lot
Alexandria	410/16
Alexandria	410/18

Alexandria	416/13
Alexandria	416/14
Alexandria	416/4
Danbury	403/19
Danbury	403/20
Danbury	403/18
Danbury	401/1
Orange	4/18
Grafton	8/923
Grafton	8/923-1
Grafton	8/923-2
Grafton	7/106
Grafton	13/1235
Grafton	8/929

All defined terms in this Exhibit shall have the meaning set forth in the Lease.

566372_1

MERRIMACK COUNTY RECORDS
Kathi L. Guay, CPO, Register

RETURN TO:
ORR & RENO, P.A.
1 EAGLE SQUARE
CONCORD, NH 03301

451.22

069

COPY

Doc # 0011347 Jul 17, 2009 1:26 PM
Register of Deeds, Grafton County

NOTICE OF WIND ENERGY LEASE AGREEMENT

NOTICE IS HEREBY GIVEN of a certain Wind Energy Lease Agreement by and between the parties identified in this Notice, of property owned by **H & H Investments, LLC** located in the Towns of Alexandria, Grafton and Orange in Grafton County and in the Town of Danbury in Merrimack County, as follows:

LESSORS: **H & H Investments, LLC**
P.O. Box 129
Francestown, New Hampshire 03403

LESSEE: **Iberdrola Renewables USA, Ltd.**
201 King of Prussia Road, Suite 500
Radnor, PA 19087

PREMISES: An exclusive lease to the use of a portion of the Landlord's land and improvements located in the Towns of Alexandria, Danbury, Grafton and Orange, in the counties of Grafton and Merrimack, New Hampshire, described in that certain Fiduciary Deed from Marilyn F. Serra, sole Trustee of the Declaration of Trust of Charles F. Trumpetto dated February 6, 2000, as amended, to H & H Investments, LLC, which deed is dated June 28, 2006 and recorded in the Merrimack County Registry of Deeds at Book 2910, Page 1262 and in the Grafton County Registry of Deeds at Book 3304, Page 183, said premises further identified on EXHIBIT A attached hereto.

TERM: The Development Period of the Lease shall be five (5) years with a renewal term of 2 years. The Extended Term of the Lease is twenty-five (25) years beginning on the Commencement of Construction as defined in the Lease, with two (2) renewals terms of ten (10) years each.

LESSORS:

H & H INVESTMENTS, LLC

By: Donald H Hardwick, member
Donald H. Hardwick, Sr., Member
Duly authorized

By: Teresa Hardwick, Member
Teresa Hardwick, Member
Duly authorized

STATE OF NEW HAMPSHIRE
COUNTY OF HILLSBOROUGH

The foregoing instrument was acknowledged before me this 2nd day of JUNE 2009, by Donald H. Hardwick, Sr., a duly authorized Member of H & H Investments, LLC, a New Hampshire limited liability company, on behalf of the said company.

MARLENE MOSHER PAULSEN STATE OF - MY - COMMISSION EXPIRES MARCH 26, 2013 NEW HAMPSHIRE NOTARY PUBLIC

Marlene Mosher Paulsen
Notary Public/Justice of the Peace
Print Name: MARLENE MOSHER PAULSEN
My Commission Expires: 03/26/2013

STATE OF NEW HAMPSHIRE
COUNTY OF HILLSBOROUGH.

The foregoing instrument was acknowledged before me this 2nd day of JUNE 2009, by Teresa Hardwick, a duly authorized Member of H & H Investments, LLC, a New Hampshire limited liability company, on behalf of the said company.

Marlene Mosher Paulsen
Notary Public/Justice of the Peace
Print Name: MARLENE MOSHER PAULSEN
My Commission Expires: 03/26/2013

MARLENE MOSHER PAULSEN STATE OF - MY - COMMISSION EXPIRES MARCH 26, 2013 NEW HAMPSHIRE NOTARY PUBLIC

BK3629PG0816

LESSEE:

IBERDROLA RENEWABLES USA, LTD.

LEGAL JN

By: [signature]
Name: David C Shadle
Title: Authorized Representative
Duly authorized

By: [signature]
Name: Trevor Mihalik
Title: Authorized Representative
Duly authorized

COMMONWEALTH/STATE OF Pennsylvania
COUNTY OF Delaware

The foregoing instrument was acknowledged before me this 8th day of June 2009, by David C Shadle, a duly authorized Representative of Iberdrola Renewable Energies, a Delaware corporation, on behalf of the said corporation.

NOTARIAL SEAL
MARIA ROJAS
Notary Public
RADNOR TWP, DELAWARE COUNTY
My Commission Expires Nov 9, 2011

[signature]
Notary Public/~~Justice of the Peace~~
Print Name: Maria Rojas
My Commission Expires: 11/9/11

COMMONWEALTH/STATE OF Oregon
COUNTY OF Multnomah

The foregoing instrument was acknowledged before me this 10th day of June 2009, by Trevor Mihalik, a duly authorized representative of Iberdrola Renewables USA Ltd, a Delaware corporation, on behalf of the said corporation.

OFFICIAL SEAL
KATE O'CONNELL
NOTARY PUBLIC - OREGON
COMMISSION NO. 414502
MY COMMISSION EXPIRES FEB 21, 2011

Kate Oconnell
Notary Public/~~Justice of the Peace~~
Print Name: Kate O'Connell
My Commission Expires: 02/21/2011

EXHIBIT A

TO
NOTICE OF WIND FARM LEASE AGREEMENT
BETWEEN
H&H INVESTMENTS, LLC
AND
IBERDROLA RENEWABLES USA, LTD.

DESCRIPTION OF PROPERTY

The Property is the land and improvements, together with all rights appurtenant thereto as described in the Lease, located in the Towns of Grafton, Danbury, Orange and Alexandria, New Hampshire described in that certain Fiduciary Deed from Marilyn F. Serra, sole Trustee of the Declaration of Trust of Charles F. Trumpetto dated February 6, 2000, as amended, to H&H Investments, LLC, which deed is dated June 28, 2006 and recorded in the Merrimack County Registry of Deeds at Book 2910, Page 1262 and the Grafton County Registry of Deeds at Book 3304, Page 183, and is described as follows:

"Picard Lot"

A certain tract of land, with the buildings thereon, situated in the "Wild Meadows" section of the Town of Grafton, Grafton County, State of New Hampshire, bounded and described as follows:

Southerly by the highway; westerly by land formerly owned by Daniel B. Smith and John Tinkham; northerly by land formerly known as the Williams Place; and easterly by land formerly owned by the heirs of Greeley Sulloway.

Excepting and reserving, to the extent that the same still exists, a certain right-of-way or right to a certain lane or cow path, over and across the northwesterly corner of the premises heretofore described.

"Brailey Lot"

Two certain tracts of land with the buildings thereon situated in Alexandria, Grafton County, State of New Hampshire, and bounded and described as follows, to wit:

Tract 1.

Beginning at a stone and iron stake at the Northwest corner of the within described tract, on the Easterly side of the highway leading from Grafton to Alexandria Four Corners, so-called, and on line of land of Edgar (Ned) Haynes; thence running Southeasterly on line of land of said Haynes two hundred twenty-one (221) feet to an iron stake on the Northerly line of the second tract herein described; thence Westerly along said second tract one hundred ninety-two (192) feet to the highway; thence Northerly along said highway seventy-nine (79) feet to the point of beginning. Meaning hereby to describe a triangular piece of land.

Tract 2.

Beginning at the Southwest corner of the within-described tract, on the Easterly side of the highway leading from Grafton to Alexandria Four Corners and on the Grafton-Alexandria Town Line, said Town Line also marking line of land formerly of Alfred Williams and now of the said Charles F. Trumpetto; thence running Northerly along said highway to the Southwest corner of the first tract herein described; thence Easterly along said first tract, and continuing on the same course along land of Edgar (Ned) Haynes to a maple tree standing in an old wire fence at the corner of land of said Haynes, land formerly of one Hodgdon, now of the Sulloway Heirs, and land formerly of Alfred Williams, subsequently of Charles F. Trumpetto; thence Southwesterly along land formerly of said Williams, subsequently of Trumpetto, to the Grafton-Alexandria Town Line; thence Westerly along said Town Line by land of said Trumpetto to the point of beginning. Excepting from said tract a parcel in the Southwest corner fronting 143 feet on the highway and 250 feet on the Town Line, sold to Ernest Gilman by deed recorded Lib. 882, Fol. 412.

"Danise Lots A"

The following described tracts of land with any improvements thereon in the Town of Alexandria in the County of Grafton, bounded and described as follows, to wit:

Beginning at the Southwesterly corner of lot 9; thence on the head or cross line of said lot to the Southerly corner of said lot, being 165 rods; thence North 13 Degrees West 28 rods on the side line of said lot; thence turning and running about 140 rods to strike a beech tree standing on the Westerly side of said lot 128 rods from the Southwesterly corner of said lot; thence South 13 degrees East on said westerly line to the said Southwesterly corner of said lot, being the bound begun at, excepting and reserving that part of said premises which was deeded to Isaac Bailey.

"Robbins Lots"

TRACTS IN GRAFTON

Certain tracts or parcels of land with any improvements thereon situated in Grafton in the County of Grafton and State of New Hampshire, bounded and described as follows:

TRACT #1: Bounded easterly by Danbury Town line; southerly and westerly by Wild Meadow Pond and land formerly owned by John Tinkham; westerly and northerly by the highway to the easterly line of Nicanor Heath place, so-called; northwesterly by land formerly owned by Nicanor Heath; and northerly by Williams place, so-called, and land formerly of John Tinkham to the Danbury Town line.

TRACT #2: Also another parcel or tract of land known as cow pasture and big woods, bounded and described as follows:

Beginning at the northeast corner, northerly by land formerly owned by D. B. Smith; westerly by land formerly owned by D. B. Smith and Greeley Sulloway Heirs and so-called Smiley lot; southerly by Putney place, so-called, and Dan Peters land, so-called; easterly by Dan Peters land, George Grant, and John Tinkham land to starting point.

TRACT #3: Also another parcel or tract of land known as Mountain Pasture, bounded and described as follows:

Beginning at northeast corner, easterly by land owned by Sulloway Heirs; southerly and westerly by Smiley lot; westerly by old highway; northerly by land formerly owned by D. B. Smith to first mentioned bound.

Excepting and reserving from Tract #2 described above that small portion thereof which was conveyed by G. Wesley Sulloway to Charles Swenson, et als, by deed dated May 14, 1954, and recorded in the Grafton County Registry of Deeds, Book 851, Page 264, to which deed reference is made for a more particular description of the premises hereby excepted and reserved.

TRACTS IN GRAFTON AND ALEXANDRIA

Certain parcels of land, together with all buildings thereon standing, situate in the Town of Grafton and Alexandria in the State of New Hampshire, bounded and described as follows:

Parcel 1. In the Town of Grafton, bounded on the North by land now or formerly of Randolph Lucas; on the East by land owned formerly by Sybil Smith and Daniel B. Smith; on the South by land formerly owned by James R. Smiley and Martin M. Powers; on the West by land owned now or formerly by Randolph Lucas, being all and the same premises conveyed to Gilbert W. Sulloway by the Town of Grafton by its deed dated February 16, 1942, and recorded in Book 704, Page 280.

Parcel 2. In the Towns of Grafton and Alexandria, being all and the same premises described in deed of Winnifred S. Gray, Gdn., to Gilbert W. Sulloway, under date of April 30, 1930, and recorded in Book 620, Page 226. See also deed of Gilbert W. Sulloway to Lucette L. Sulloway of an undivided one-half interest, recorded in Book 639, Page 585.

Parcel 3. In the Towns of Alexandria and Grafton, being described as two parcels, one being the northerly half of a fifty (50) acre lot in the Town of Alexandria, and the second parcel containing about one hundred (100) acres in the Town of Grafton, and being all and the same premises described in deed of Alfred J. Kidder to G. Wesley Sulloway, dated August 18, 1941, and recorded in Book 700, Page 177.

Parcel 4. In the Town of Grafton, being all and the same premises described in a Warranty Deed from Josephine M. Tinkham, widow of John W. Tinkham, and Anna G. Tinkham, et al. children and heirs-at-law of said John W. Tinkham to Gilbert W. Sulloway, dated June 12, 1917, and recorded in Book 523, Page 477, to which deed reference is hereby made and had. See also deed of Gilbert W. Sulloway to Lucette L. Sulloway of an undivided one-half interest, recorded in Book 639, Page 585.

Parcel 5. In the Town of Alexandria, being all and the same premises described in deed from the Town of Alexandria to G. W. Sulloway, dated January 31, 1940, and recorded in Book 688, Page 333.

Parcel 6. In the Town of Grafton, bounded as follows:

Northerly by land now or formerly of George Grant; easterly by land formerly owned by Sybil Smith; southerly by land formerly owned by Sybil Smith and land formerly owned by John Tinkham; westerly by land formerly owned by Daniel B. Smith, known as the Kemp land.

Excepting and reserving, however, from this conveyance the premises conveyed by said Sterling to Raymond W. Martin by deed dated April 25, 1956, and recorded in Grafton County Registry of Deeds, Book 879, Page 378, bounded and described as follows:

"A certain tract of land with buildings thereon, situated in the Town of Grafton, County of Grafton and State of New Hampshire, and bounded and described as follows, to wit:

Beginning at the brook and running in a northwesterly direction across the highway, along the stone wall to an iron pin in the wall; thence in a southeasterly direction along a stone wall to a yellow birch tree in the end of wall by the brook; thence in a southerly direction along the brook, crossing the highway to the first mentioned bound."

Also the rights to the well of the Dan Smith property, excepted and reserved from the aforementioned deed to Martin to the extent they remain in existence.

Also excepting and reserving from this conveyance the premises previously sold by Edward C. Sterling to Marie E. Landry, bounded and described approximately as follows:

(For a more particular description, see deed in Book 913, Page 239.) A certain tract of land with the buildings thereon, situate in Grafton, County of Grafton and State of New Hampshire, bounded and described as follows, to wit:

Located on the westerly side of the highway leading from East Grafton to Alexandria and known as the Wild Meadows Road. Beginning at an iron pin at the side of said highway thence running northerly about twelve hundred feet (1200') to another iron pin; thence westerly at a right angle to a third iron pin; thence southerly along a line parallel to the said highway, or roughly so, to a fourth iron pin; thence easterly at a right angle to the point of beginning.

TRACTS IN ORANGE

A certain tract of land, together with the buildings thereon, located in the Town of Orange, County of Grafton and State of New Hampshire, bounded and described as follows:

Commencing at the northerly corner at stake and stone; thence southerly by land now or formerly of Joseph French and one Nelson Gifford to stake and stones; thence easterly by land now or formerly of Sleeper Stevens to stake and stones; thence southerly by said Sleeper Stevens land to stake and stone; thence northerly by land now or formerly of Nelson Gifford and John Bullock to stake and stone; thence northerly by said John Bullock's land to Alexandria's new town line; thence northerly by said Alexandria's new town line to the Gore lot line; thence westerly by the said Gore lot line to point begun at. Being the property formerly owned by Thomas F. Brown and conveyed by will of Thomas F. Brown and heirs.

Also another parcel of land in said Orange, bounded and described as follows:

Commencing at the stake and stones which is the point of beginning of the parcel above described and running westerly by land now or formerly of Joseph French about 160 rods to a stake and stones; thence northerly by land now or formerly owned by William Chellis to stake and stones; thence easterly to a pile of stones at the top of the mountain; thence southerly by land now or formerly owned by Eugene Moore to the point begun at.

Excepting and reserving, however, that portion of the above-described premises estimated to contain one acre, more or less, conveyed by said Sulloways to Alfred B. Therrien, et als, by deed recorded December 3, 1954 at Vol. 857, Page 262, to which reference is made for a more particular description of said excepted portion.

"<u>Brownell Lots</u>"

<u>Tract #3</u>

Certain tracts or parcels of land situate in Alexandria, County of Grafton, and State of New Hampshire, bounded and described as follows:

A certain tract of land situated in said Alexandria bounded on the east by land now or formerly of Samuel A. Patten running to Danbury Corner; on the north by the Washburn Road, so-called, on the west by land now or formerly of S. Scott Patten; on the south running from Danbury Corner parallel with the Washburn Road.

Also a certain other tract of land situate in said Alexandria and bounded and described as follows:

A certain other tract of land on the southerly side of Washburn Road, so-called, and bounded and described as follows:

Northerly by the Washburn Road; easterly by the westerly line of land now or formerly of the General Electric Company, formerly George D. Patten; southerly by land formerly of Jonas Patten formerly known as the Place Farm; and westerly by land now or formerly of Amos Blake, formerly Samuel A. Patten, being the same land conveyed in two tracts one by John and Lovina Patten to Nellie Patten, January 11, 1881. The other by said Lovina Patten, George E. Patten and Mary A. Clough to Hadlet B. Patten, August 21, 1882.

Also a certain other tract of land situated in said Alexandria, bounded and described as follows:

Beginning at the northeast corner of land formerly of Amos A. Blake at the Washburn Road, so-called; thence southerly by said Blake land to land of Edward Blake; thence southwesterly to a stone monument at the town line between Alexandria and Danbury; thence northerly to said Washburn Road; thence easterly by said Road to the bound begun at.

There is <u>excepted and reserved out of the above-described tracts of land</u> the following two described parcels of land:

<u>EXCEPTION NO. 1</u>

A certain tract or parcel of land situated on the southerly side of Washburn Road, so-called, in Alexandria, County of Grafton, and State of New Hampshire, bounded and described as follows:

Beginning at a stake in the ground which is situated 180 feet, more or less, easterly of a "line" tree, blazed; and running thence in an easterly direction along the southerly side of said Washburn Road 400 feet, more or less, to a stake in the ground at other land of Stanley W. Fenerty; thence turning at an internal angle of 55° and running a southwesterly direction approximately 1000 feet to a stone post, which stone post marks the division line between Merrimack County and Grafton County, thence running along other land of Stanley W. Fenerty in a northwesterly direction a distance of approximately 850 feet to the post driven in the ground at the point of beginning.

Meaning and intending hereby to exclude a triangular strip of land which said strip is a part of the premises contained in the first tract of land described in deed of Fred C. Tobey to Stanley W. Fenerty dated April 30, 1959 and recorded in Book 927, Page 143 of Grafton County Registry of Deeds.

Said Exception No. 1 having been conveyed by Stanley W. Fenerty to Ronald A. Davis and Barbara W. Davis by deed dated December, 1966.

EXCEPTION NO. 2

Also a certain tract or parcel of land situated on the southerly side of Washburn Road, so-called, in said Alexandria, bounded and described as follows:

Beginning at the northeasterly corner of land of Ronald and Barbara Davis, above referred to, and at the northwesterly corner of the parcel herein conveyed and running thence in an easterly direction along the southerly side of Washburn Road, so-called, a distance of 100 feet, more or less, to a stake; thence in a southwesterly direction along land conveyed to Wilmer L. Brownell, et ux, to the northerly shore of Patten Brook, so-called; thence in a westerly direction along said Patten Brook 100 feet, more or less, to land of Ronald and Barbara Davis; thence in a northeasterly direction approximately 400 feet, more or less, along said Davis land to the point of beginning.

Meaning and intending hereby to exclude a portion of the premises acquired by Stanley W. Fenerty by Deed of Fred C. Tobey, Jr. dated April 30, 1959 and recorded in Grafton County Records, Book 927, Page 143.

EXCEPTING AND RESERVING therefrom a tract of 25 acres, more or less, conveyed by said Brownells to Robert G. Taylor and Marianna E. Taylor by deeds dated October 9, 1967 and recorded in the Grafton County Registry of Deeds, Book 1069, Page 302, to which reference is made for a more particular description.

Tract #4

A certain tract or parcel of land situated in the Town of Alexandria, in the County of Grafton and State of New Hampshire, bounded and described as follows, to wit:

Beginning at the south corner of the tract on the Danbury Town Line; thence northerly on said Danbury line eighty-five (85) rods to a stake and stones; thence south 65° east to a stake and stone standing on the easterly line of Jacob Patton land, now or formerly; thence southerly to bound begun at.

Also conveying as an appurtenance to the "Brownell Lots" a right-of-way by foot or with vehicle for purposes of ingress and egress over the Dicey Lot, so-called, from the Washburn Road, so-called.

EXCEPTING from the aforementioned "Brownell Lots" located in Alexandria, the following:

1) All of Tax Map 410, Lot 16-2, being a ten (10) acre lot, more or less, located at 1165 Washburn Road, Alexandria, New Hampshire; and

2) All of Tax Map 21, Lot 21-1, being a 7.1 acre lot, more or less situated on Washburn Road, Alexandria, New Hampshire.

"Robbins Lots"

TRACTS IN DANBURY

Certain tracts or parcels of land with any improvements thereon situated in Danbury in the County of Merrimack and State of New Hampshire, bounded and described as follows:

TRACT #1: Commencing at the Town line between Danbury and Grafton at the corner of land now or formerly of one Sulloway; thence northerly by said Town line to land now or formerly owned by Dexter Perkins; thence southerly by land now or formerly of said Perkins to the range line; thence southerly by the range line to land now or formerly owned by C. A. and G. M. Sulloway; thence northerly to the first mentioned bound, said premises being known as the old Tinkham place.

Reference is made to the deed from Florence E. Barrett to G. Wesley Sulloway dated August 23, 1957, duly recorded.

TRACT #2: Containing by estimate thirty acres, more or less, and bounded and described as follows: Bounded northerly and easterly by land supposed to be owned now or formerly by George W. Sawing of Grafton; southerly by the Hale Mountain pasture, so-called, and westerly by the highway leading to the Hopper, so called, in said Danbury.

TRACT #3: Commencing at a stake and stones at the North corner of said lot on the Grafton Town Line; thence South on the Grafton Town Line to land now or formerly owned by Sulloway Heirs; thence southeasterly on land of Sulloway Heirs to the old highway; thence northerly on said highway to the Tinkham land, so-called; thence northwesterly on said Tinkham land to the first mentioned bound.

TRACT #4: Bounded westerly by land now or formerly of Cyrus A. and the heirs of Gilbert M. Sulloway; northerly and easterly by land now or formerly of Cyrus A. Sulloway and the heirs of Gilbert M. Sulloway and W. Cornell; easterly by land now or formerly of said Cornell and land formerly of John C. Pillsbury; southerly and westerly by land formerly of said Pillsbury and land now or formerly of George S. Tenney, the premises known as the Eastman Place.

TRACT #5: Westerly by the Grafton Town line; thence northerly by the land of the Sulloway heirs to the Eastman Road, so-called; thence by said Eastman Road to land formerly owned by John W. Pillsbury; southerly and westerly by land now or formerly owned by Lewis M. Bean to point of beginning.

Reserving the Town Highway through the above-described premises formerly called the Hopper Road. Also reserving a mining right in the Sanborn Pasture, so-called.

TRACT #6: Westerly by the Grafton Town Line; southerly by land formerly owned by William H. Burleigh and land formerly owned by Lucien Follansbee; easterly and northerly by said Follansbee's land and land now or formerly owned by I. B. Sargent, Peter Kimball and Nicanor Heath.

"Brownell Lots"

Tract #1

Certain tracts or parcels of land situated in Danbury, County of Merrimack, State of New Hampshire and being Lot #10 and Lot #46 as said lots are shown and laid out on the original lay-out or plan of the Town of Danbury.

Tract #2

A certain tract of land situated in said Danbury, bounded and described as follows, to wit:

Commencing at the southeast corner of Lot No. 46, thence northerly on the east side line of said Lot No. 46 about forty (40) rods to a corner at stake and stones; thence westerly about eighty (80) rods on a straight line to a stake and stones standing on the west line of said lot and parallel with the east side line about forty (40) rods to the southerly line of said Lot No. 46; thence easterly along the south line of said lot eighty (80) rods (said south line supposed to be the range line) to the point of beginning.

Also all of the mineral or inning rights appurtenant to a certain tract of land situated in said Danbury, bounded and described as follows, to wit:

Easterly and northerly by the Alexandria Town Line, westerly land of Dan Braley and Catherine Braley; and southerly by the Rolf Lot, so-called; being known as the I. H. Bailey homestead and being the easterly half of Lot #10. Containing one hundred acres.

Reference is made to deed of Standard Mica to Errol Perkins dated February 19, 1914 and entered in Book 416, Page 133 of Merrimack County Records. Said mining rights were taken by said Town of Danbury for nonpayment of taxes owed by said Standard Mica Company for the years 1915, 1916, 1917 and 1918.

Also conveying as an appurtenance to the "Brownell Lots" a right-of-way by foot or with vehicle for purposes of ingress and egress over the Dicey Lot, so-called, from the Washburn Road, so-called.

For purposes of further clarification, Landowner and Lessee have attached a map as part of Exhibit A to the Lease showing the Property. In addition, the Landowner and Lessee have attached a map as part of Exhibit A to the Lease showing the "no-build" area near Grants Pond in which Lessee shall not build any improvements.

Based upon the records available to them as of the date of the Lease, Landowner and Lessee have estimated that the portion of the Property that will be subject to the Lease upon the completion of the Windpower Facilities is comprised of that land commonly known as the following tax lots:

Town	Tax Map/Lot
Alexandria	410/16
Alexandria	410/18

Alexandria	416/13
Alexandria	416/14
Alexandria	416/4
Danbury	403/19
Danbury	403/20
Danbury	403/18
Danbury	401/1
Orange	4/18
Grafton	8/923
Grafton	8/923-1
Grafton	8/923-2
Grafton	7/106
Grafton	13/1235
Grafton	8/929

All defined terms in this Exhibit shall have the meaning set forth in the Lease.

BK3629PG0826

Doc#: 739344
Book: 3139 Pages: 0703 - 0716
06/26/2009 1:11PM

MCRD Book 3139 Page 703

COPY

Recording requested by,
and after recording, return to:

Iberdrola Renewables, Inc.
1125 NW Couch, Suite 700
Portland, OR 97209
Attention: Toan Nguyen

069

63,384
2

Doc # 0011348 Jul 17, 2009 1:26 PM
Register of Deeds, Grafton County

LT1-2-739344-1

LT2-3139-703-14

(Space above this line for Recorder's use only)

NONDISTURBANCE AND ATTORNMENT AGREEMENT

THIS NONDISTURBANCE AND ATTORNMENT AGREEMENT (this "**Agreement**") is made, dated and effective as of JUNE 2, 2009 (the "**Effective Date**"), by and among H&H Investments, LLC ("**Owner**"), whose address is 1580 Bennington Road, P.O. Box 129, Francestown, NH 03043, the owner of the real property located in Merrimack and Grafton Counties, State of New Hampshire and described in Exhibit A attached hereto and incorporated herein by this reference (the "**Property**"), **D.H. Hardwick & Sons, Inc.** ("**Timber Right Holder**"), whose address is 301 Francestown Road, Bennington NH 03442 (*Mailing: P.O. Box 430, Antrim, NH 03440*), and Iberdrola Renewables USA, Ltd., a Delaware Corporation ("**Iberdrola**"), whose address is 1125 NW Couch, Suite 700, Portland, Oregon 97209, the Lessee under that Wind Energy Lease Agreement dated JUNE 2, 2009, hereinafter described.

WITNESSETH

WHEREAS, Owner and Iberdrola entered into a Wind Energy Lease Agreement with an effective date of JUNE 2, 2009 (the "**Agreement**"); and

WHEREAS, Timber Right Holder is the grantee in two Fiduciary Deeds (one in Merrimack County Registry of Deeds at Book 2910, Page 1277 and one in Grafton County Registry of Deeds at Book 3304, Page 0152) both recorded on July 14, 2006, which transfer timber rights, forest products and other rights from the previous owner "Trust of Charles F. Trumpetto".

NOW, THEREFORE, in consideration of the foregoing and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, and of the mutual benefits to accrue to the parties hereto, it is hereby declared, understood and agreed as follows:

1. Timber Right Holder hereby (i) consents to the Agreement, which Agreement is hereby incorporated herein by this reference, for the purposes stated therein, and (ii) agrees that (a) Timber Right Holder shall recognize the Agreement and the rights of Iberdrola, its successors, lessees or assigns thereunder, and Iberdrola's possession of the Property and rights under the Agreement shall not be

diminished or interfered with by Timber Right Holder or its successors or assigns, (b) so long as the Agreement is in full force and effect and Iberdrola (or its successor in interest) is not in material default under the Agreement beyond any applicable cure period, Timber Right Holder will not join Iberdrola as a party defendant in any action or proceeding foreclosing the Timber Contract against the Property unless such joinder is necessary to foreclose the Timber Contract as to the rights of any one or more third parties and then only for such purpose and not for the purpose or with the effect of terminating or limiting the Agreement and that foreclosure or other enforcement of the Timber Contract will not terminate the Agreement entered into pursuant thereto as to any such real property or disturb the rights of Iberdrola or its successors, lessees, or assigns under the Agreement, (c) the Agreement shall survive any foreclosure of, or forfeiture under, the Timber Contract or under any other lien held by Timber Right Holder affecting the Property or any interest therein, and (d) in the event Timber Right Holder or any other purchaser at a foreclosure or trustee's sale succeeds to the interest of Owner in the Property and under the Agreement by reason of any foreclosure of the Timber Contract or the acceptance by Timber Right Holder of a deed in lieu of foreclosure, or by any other manner, it is agreed that the Property shall remain subject to the Agreement and that Timber Right Holder or such other purchaser shall be bound to Iberdrola, and Iberdrola shall attorn to and be bound to Timber Right Holder or such other purchaser rather than Owner under all of the terms, covenants and conditions of the Agreement for the remaining balance of the term thereof, including any extensions therein provided, with the same force and effect as if Timber Right Holder or such other purchaser were the "Owner" under the Agreement. The foregoing agreement shall be effective and self-operating without the execution of any further instruments on the part of any of the parties to this Agreement, immediately upon Timber Right Holder or such other purchaser succeeding to the interest of Owner under the Agreement.

2. Timber Right Holder, in the event of attornment, shall have the same remedies in the event of any default by Iberdrola (beyond any period given Iberdrola to cure such default) in the payment of annual base rent or additional rent or in the performance of any of the terms, covenants, and conditions of the Agreement on Iberdrola's part to be performed that are available to Owner under the Agreement. Iberdrola shall have the same remedies against Timber Right Holder for the breach of an agreement contained in the Agreement that Iberdrola might have had against Owner if Timber Right Holder had not succeeded to the interest of Owner.

3. Owner, as landlord under the Agreement, acknowledges and agrees for itself and it heirs, successors, and assigns to each of the following:

(a) This Agreement does not in any way release Owner from its obligations to comply with the terms, provisions, conditions, covenants, agreements, and clauses of the Timber Contract or any other documents executed in connection with the Timber Contract.

(b) In the event of a default under the Timber Contract, or any of the other documents executed in connection with the Timber Contract, Owner hereby consents to Iberdrola's attornment to Timber Right Holder and, upon such event, following written notice to Iberdrola from Timber Right Holder of such default upon which Iberdrola shall be entitled to conclusively rely, Iberdrola shall pay all rent and all other sums due under the Agreement to Timber Right Holder as provided in the Agreement. All sums so paid shall be credited against the rent and such other sums as may be payable under the Agreement, and Iberdrola shall have no liability to Owner for paying the same to Timber Right Holder.

4. This Agreement shall be governed by and construed in accordance with the laws of the State of Oregon.

5. The agreements contained herein shall run with the land and shall be binding upon and inure to the benefit of the parties hereto and the respective heirs, administrators, executors, legal representatives, successors and assigns of the parties hereto.

6. This Agreement constitutes the entire understanding and agreement of the parties as to the matters set forth in this Agreement. No alteration of or amendment to this Agreement shall be effective unless given in writing and signed by the party or parties sought to be charged or bound by the alteration or amendment.

7. Any person who signs this Agreement on behalf of Owner, Timber Right Holder and Iberdrola represents and warrants that he or she has authority to execute this Agreement.

8. This Agreement may be executed simultaneously or in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same Agreement.

9. Should any action or proceeding be commenced to enforce any of the provisions of this Agreement or in connection with its meaning, the prevailing party in such action shall be awarded, in addition to any other relief it may obtain, its reasonable costs and expenses, not limited to taxable costs, and reasonable attorney's fees.

10. The parties hereby adopt and incorporate into this Agreement fully the Recitals set forth above.

IN WITNESS WHEREOF, the undersigned have executed this Agreement as of the Effective Date.

TIMBER RIGHT HOLDER:

By: Donald H Hardwick SR. Pres
Printed Name: D. H. HARDWICK & SONS, INC
Title: PRESIDENT

OWNER:

By: Donald H Hardwick Member
Printed Name: H & H INVESTMENTS, LLC
Title: MEMBER

IBERDROLA:

LEGAL
TN

By: David C Shadle
Printed Name: David C Shadle
Title: Authorized Representative

By:
Printed Name: Trevor Mihalik
Title: Authorized Representative

STATE OF NEW HAMPSHIRE)ss.
COUNTY OF HILLSBOROUGH)

This instrument was acknowledged before me JUNE 2, 2009, by DONALD H. HARDWICK, SR, Member of Hardwick & Sons, on its behalf.

Marlene Mosher Paulsen
Notary Public
My commission expires: 03/26/2013
Commission No.:

MARLENE MOSHER PAULSEN
STATE OF NEW HAMPSHIRE
MY COMMISSION EXPIRES MARCH 26, 2013
NOTARY PUBLIC

STATE OF NEW HAMPSHIRE)ss.
COUNTY OF HILLSBOROUGH)

This instrument was acknowledged before me JUNE 2, 2009, by DONALD H. HARDWICK, SR., Member of H&H Investments, LLC, on its behalf.

Marlene Mosher Paulsen
Notary Public
My commission expires: 03/26/2013
Commission No.:

MARLENE MOSHER PAULSEN
STATE OF NEW HAMPSHIRE
MY COMMISSION EXPIRES MARCH 26, 2013
NOTARY PUBLIC

Commonwealth of Pennsylvania
~~STATE OF OREGON~~)ss.
COUNTY OF ~~MULTNOMAH~~ Delaware)

This instrument was acknowledged before me June 8, 2009, by David C. Shadle and ____, Authorized Representatives of Iberdrola Renewables USA, Ltd., a Delaware corporation, on its behalf.

Notary Public
My commission expires: 11/9/11
Commission No.:

NOTARIAL SEAL
MARIA ROJAS
Notary Public
RADNOR TWP, DELAWARE COUNTY
My Commission Expires Nov 9, 2011

INDIVIDUAL ACKNOWLEDGMENT

State/Commonwealth of Oregon } ss.
County of Multnomah

On this the 10th (Day) day of June (Month), 2009 (Year), before me, Kate O'Connell (Name of Notary Public), the undersigned Notary Public, personally appeared Trevor Mihalik (Name(s) of Signer(s)),

☑ personally known to me – **OR** –

☐ proved to me on the basis of satisfactory evidence

to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged to me that he/she/they executed the same for the purposes therein stated.

OFFICIAL SEAL
KATE O'CONNELL
NOTARY PUBLIC - OREGON
COMMISSION NO. 414502
MY COMMISSION EXPIRES FEB 21, 2011

Place Notary Seal and/or Any Stamp Above

WITNESS my hand and official seal.

Kate O'Connell
Signature of Notary Public

Kate O'Connell
Other Required Information (Printed Name of Notary, Residence, etc.)

OPTIONAL

Although the information in this section is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

Description of Attached Document

Title or Type of Document: Wind Energy Lease Agreement

Document Date: ______ Number of Pages: ______

Signer(s) Other Than Named Above: David Schadle, Donald Hardwick, Teresa Hardwick

Right Thumbprint of Signer
Top of thumb here

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EXHIBIT A

Description of Property

That certain real property situated in Merrimack and Grafton Counties, State of New Hampshire, more particularly described as:

"Picard Lot"

A certain tract of land, with the buildings thereon, situated in the "Wild Meadows" section of the Town of Grafton, Grafton County, State of New Hampshire, bounded and described as follows:

Southerly by the highway; westerly by land formerly owned by Daniel B. Smith and John Tinkham; northerly by land formerly known as the Williams Place; and easterly by land formerly owned by the heirs of Greeley Sulloway.

Excepting and reserving, to the extent that the same still exists, a certain right-of-way or right to a certain lane or cow path, over and across the northwesterly corner of the premises heretofore described.

"Brailey Lot"

Two certain tracts of land with the buildings thereon situated in Alexandria, Grafton County, State of New Hampshire, and bounded and described as follows, to wit:

Tract 1.

Beginning at a stone and iron stake at the Northwest corner of the within described tract, on the Easterly side of the highway leading from Grafton to Alexandria Four Corners, so-called, and on line of land of Edgar (Ned) Haynes; thence running Southeasterly on line of land of said Haynes two hundred twenty-one (221) feet to an iron stake on the Northerly line of the second tract herein described; thence Westerly along said second tract one hundred ninety-two (192) feet to the highway; thence Northerly along said highway seventy-nine (79) feet to the point of beginning. Meaning hereby to describe a triangular piece of land.

Tract 2.

Beginning at the Southwest corner of the within-described tract, on the Easterly side of the highway leading from Grafton to Alexandria Four Corners and on the Grafton-Alexandria Town Line, said Town Line also marking line of land formerly of Alfred Williams and now of the said Charles F. Trumpetto; thence running Northerly along said highway to the Southwest corner of the first tract herein described; thence Easterly along said first tract, and continuing on the same course along land of Edgar (Ned) Haynes to a maple tree standing in an old wire fence at the corner of land of said Haynes, land formerly of one Hodgdon, now of the Sulloway Heirs, and land formerly of Alfred Williams, subsequently of Charles F. Trumpetto; thence Southwesterly along land formerly of said Williams, subsequently of Trumpetto, to the Grafton-Alexandria

Town Line; thence Westerly along said Town Line by land of said Trumpetto to the point of beginning. Excepting from said tract a parcel in the Southwest corner fronting 143 feet on the highway and 250 feet on the Town Line, sold to Ernest Gilman by deed recorded Lib. 882, Fol. 412.

"Danise Lots A"

The following described tracts of land with any improvements thereon in the Town of Alexandria in the County of Grafton, bounded and described as follows, to wit:

Beginning at the Southwesterly corner of lot 9; thence on the head or cross line of said lot to the Southerly corner of said lot, being 165 rods; thence North 13 Degrees West 28 rods on the side line of said lot; thence turning and running about 140 rods to strike a beech tree standing on the Westerly side of said lot 128 rods from the Southwesterly corner of said lot; thence South 13 degrees East on said westerly line to the said Southwesterly corner of said lot, being the bound begun at, excepting and reserving that part of said premises which was deeded to Isaac Bailey.

"Robbins Lots"

TRACTS IN GRAFTON

Certain tracts or parcels of land with any improvements thereon situated in Grafton in the County of Grafton and State of New Hampshire, bounded and described as follows:

TRACT #1: Bounded easterly by Danbury Town line; southerly and westerly by Wild Meadow Pond and land formerly owned by John Tinkham; westerly and northerly by the highway to the easterly line of Nicanor Heath place, so-called; northwesterly by land formerly owned by Nicanor Heath; and northerly by Williams place, so-called, and land formerly of John Tinkham to the Danbury Town line.

TRACT #2: Also another parcel or tract of land known as cow pasture and big woods, bounded and described as follows:

Beginning at the northeast corner, northerly by land formerly owned by D. B. Smith; westerly by land formerly owned by D. B. Smith and Greeley Sulloway Heirs and so-called Smiley lot; southerly by Putney place, so-called, and Dan Peters land, so-called; easterly by Dan Peters land, George Grant, and John Tinkham land to starting point.

TRACT #3: Also another parcel or tract of land known as Mountain Pasture, bounded and described as follows:

Beginning at northeast corner, easterly by land owned by Sulloway Heirs; southerly and westerly by Smiley lot; westerly by old highway; northerly by land formerly owned by D. B. Smith to first mentioned bound.

Excepting and reserving from Tract #2 described above that small portion thereof which was conveyed by G. Wesley Sulloway to Charles Swenson, et als, by deed dated May 14, 1954, and recorded in the Grafton County Registry of Deeds, Book 851, Page 264, to which deed reference is made for a more particular description of the premises hereby excepted and reserved.

TRACTS IN GRAFTON AND ALEXANDRIA

Certain parcels of land, together with all buildings thereon standing, situate in the Town of Grafton and Alexandria in the State of New Hampshire, bounded and described as follows:

Parcel 1. In the Town of Grafton, bounded on the North by land now or formerly of Randolph Lucas; on the East by land owned formerly by Sybil Smith and Daniel B. Smith; on the South by land formerly owned by James R. Smiley and Martin M. Powers; on the West by land owned now or formerly by Randolph Lucas, being all and the same premises conveyed to Gilbert W. Sulloway by the Town of Grafton by its deed dated February 16, 1942, and recorded in Book 704, Page 280.

Parcel 2. In the Towns of Grafton and Alexandria, being all and the same premises described in deed of Winnifred S. Gray, Gdn., to Gilbert W. Sulloway, under date of April 30, 1930, and recorded in Book 620, Page 226. See also deed of Gilbert W. Sulloway to Lucette L. Sulloway of an undivided one-half interest, recorded in Book 639, Page 585.

Parcel 3. In the Towns of Alexandria and Grafton, being described as two parcels, one being the northerly half of a fifty (50) acre lot in the Town of Alexandria, and the second parcel containing about one hundred (100) acres in the Town of Grafton, and being all and the same premises described in deed of Alfred J. Kidder to G. Wesley Sulloway, dated August 18, 1941, and recorded in Book 700, Page 177.

Parcel 4. In the Town of Grafton, being all and the same premises described in a Warranty Deed from Josephine M. Tinkham, widow of John W. Tinkham, and Anna G. Tinkham, et al. children and heirs-at-law of said John W. Tinkham to Gilbert W. Sulloway, dated June 12, 1917, and recorded in Book 523, Page 477, to which deed reference is hereby made and had. See also deed of Gilbert W. Sulloway to Lucette L. Sulloway of an undivided one-half interest, recorded in Book 639, Page 585.

Parcel 5. In the Town of Alexandria, being all and the same premises described in deed from the Town of Alexandria to G. W. Sulloway, dated January 31, 1940, and recorded in Book 688, Page 333.

Parcel 6. In the Town of Grafton, bounded as follows:

Northerly by land now or formerly of George Grant; easterly by land formerly owned by Sybil Smith; southerly by land formerly owned by Sybil Smith and land formerly owned by John Tinkham; westerly by land formerly owned by Daniel B. Smith, known as the Kemp land.

Excepting and reserving, however, from this conveyance the premises conveyed by said Sterling to Raymond W. Martin by deed dated April 25, 1956, and recorded in Grafton County Registry of Deeds, Book 879, Page 378, bounded and described as follows:

> "A certain tract of land with buildings thereon, situated in the Town of Grafton, County of Grafton and State of New Hampshire, and bounded and described as follows, to wit:
>
> Beginning at the brook and running in a northwesterly direction across the highway, along the stone wall to an iron pin in the wall; thence in a southeasterly direction along a stone wall to a yellow birch tree in the end of wall by the brook; thence in a southerly direction along the brook, crossing the highway to the first mentioned bound."

Also the rights to the well of the Dan Smith property, excepted and reserved from the aforementioned deed to Martin to the extent they remain in existence.

Also excepting and reserving from this conveyance the premises previously sold by Edward C. Sterling to Marie E. Landry, bounded and described approximately as follows:

> (For a more particular description, see deed in Book 913, Page 239.) A certain tract of land with the buildings thereon, situate in Grafton, County of Grafton and State of New Hampshire, bounded and described as follows, to wit:
>
> Located on the westerly side of the highway leading from East Grafton to Alexandria and known as the Wild Meadows Road. Beginning at an iron pin at the side of said highway thence running northerly about twelve hundred feet (1200') to another iron pin; thence westerly at a right angle to a third iron pin; thence southerly along a line parallel to the said highway, or roughly so, to a fourth iron pin; thence easterly at a right angle to the point of beginning.

TRACTS IN ORANGE

A certain tract of land, together with the buildings thereon, located in the Town of Orange, County of Grafton and State of New Hampshire, bounded and described as follows:

Commencing at the northerly corner at stake and stone; thence southerly by land now or formerly of Joseph French and one Nelson Gifford to stake and stones; thence easterly by land now or formerly of Sleeper Stevens to stake and stones; thence southerly by said Sleeper Stevens land to stake and stone; thence northerly by land now or formerly of Nelson Gifford and John Bullock to stake and stone; thence northerly by said John Bullock's land to Alexandria's new town line; thence northerly by said Alexandria's new town line to the Gore lot line; thence westerly by the said Gore lot line to point begun at. Being the property formerly owned by Thomas F. Brown and conveyed by will of Thomas F. Brown and heirs.

Also another parcel of land in said Orange, bounded and described as follows:

Commencing at the stake and stones which is the point of beginning of the parcel above described and running westerly by land now or formerly of Joseph French about 160 rods to a stake and stones; thence northerly by land now or formerly owned by William Chellis to stake and stones; thence easterly to a pile of stones at the top of the mountain; thence southerly by land now or formerly owned by Eugene Moore to the point begun at.

Excepting and reserving, however, that portion of the above-described premises estimated to contain one acre, more or less, conveyed by said Sulloways to Alfred B. Therrien, et als, by deed recorded December 3, 1954 at Vol. 857, Page 262, to which reference is made for a more particular description of said excepted portion.

"Brownell Lots"

Tract #3

Certain tracts or parcels of land situate in Alexandria, County of Grafton, and State of New Hampshire, bounded and described as follows:

A certain tract of land situated in said Alexandria bounded on the east by land now or formerly of Samuel A. Patten running to Danbury Corner; on the north by the Washburn Road, so-called, on the west by land now or formerly of S. Scott Patten; on the south running from Danbury Corner parallel with the Washburn Road.

Also a certain other tract of land situate in said Alexandria and bounded and described as follows:

A certain other tract of land on the southerly side of Washburn Road, so-called, and bounded and described as follows:

Northerly by the Washburn Road; easterly by the westerly line of land now or formerly of the General Electric Company, formerly George D. Patten; southerly by land formerly of Jonas Patten formerly known as the Place Farm; and westerly by land now or formerly of Amos Blake, formerly Samuel A. Patten, being the same land conveyed in two tracts one by John and Lovina Patten to Nellie Patten, January 11, 1881. The other by said Lovina Patten, George E. Patten and Mary A. Clough to Hadlet B. Patten, August 21, 1882.

Also a certain other tract of land situated in said Alexandria, bounded and described as follows:

Beginning at the northeast corner of land formerly of Amos A. Blake at the Washburn Road, so-called; thence southerly by said Blake land to land of Edward Blake; thence southwesterly to a stone monument at the town line between Alexandria and Danbury; thence northerly to said Washburn Road; thence easterly by said Road to the bound begun at.

There is excepted and reserved out of the above-described tracts of land the following two described parcels of land:

EXCEPTION NO. 1

A certain tract or parcel of land situated on the southerly side of Washburn Road, so-called, in Alexandria, County of Grafton, and State of New Hampshire, bounded and described as follows:

Beginning at a stake in the ground which is situated 180 feet, more or less, easterly of a "line" tree, blazed; and running thence in an easterly direction along the southerly side of said Washburn Road 400 feet, more or less, to a stake in the ground at other land of Stanley W. Fenerty; thence turning at an internal angle of 55° and running a southwesterly direction approximately 1000 feet to a stone post, which stone post marks the division line between Merrimack County and Grafton County, thence running along other land of Stanley W. Fenerty in a northwesterly direction a distance of approximately 850 feet to the post driven in the ground at the point of beginning.

Meaning and intending hereby to exclude a triangular strip of land which said strip is a part of the premises contained in the first tract of land described in deed of Fred C. Tobey to Stanley W. Fenerty dated April 30, 1959 and recorded in Book 927, Page 143 of Grafton County Registry of Deeds.

Said Exception No. 1 having been conveyed by Stanley W. Fenerty to Ronald A. Davis and Barbara W. Davis by deed dated December, 1966.

EXCEPTION NO. 2

Also a certain tract or parcel of land situated on the southerly side of Washburn Road, so-called, in said Alexandria, bounded and described as follows:

Beginning at the northeasterly corner of land of Ronald and Barbara Davis, above referred to, and at the northwesterly corner of the parcel herein conveyed and running thence in an easterly direction along the southerly side of Washburn Road, so-called, a distance of 100 feet, more or less, to a stake; thence in a southwesterly direction along land conveyed to Wilmer L. Brownell, et ux, to the northerly shore of Patten Brook, so-called; thence in a westerly direction along said Patten Brook 100 feet, more or less, to land of Ronald and Barbara Davis; thence in a northeasterly direction approximately 400 feet, more or less, along said Davis land to the point of beginning.

Meaning and intending hereby to exclude a portion of the premises acquired by Stanley W. Fenerty by Deed of Fred C. Tobey, Jr. dated April 30, 1959 and recorded in Grafton County Records, Book 927, Page 143.

EXCEPTING AND RESERVING therefrom a tract of 25 acres, more or less, conveyed by said Brownells to Robert G. Taylor and Marianna E. Taylor by deeds dated October 9, 1967 and recorded in the Grafton County Registry of Deeds, Book 1069, Page 302, to which reference is made for a more particular description.

Tract #4

A certain tract or parcel of land situated in the Town of Alexandria, in the County of Grafton and State of New Hampshire, bounded and described as follows, to wit:

Beginning at the south corner of the tract on the Danbury Town Line; thence northerly on said Danbury line eighty-five (85) rods to a stake and stones; thence south 65° east to a stake and stone standing on the easterly line of Jacob Patton land, now or formerly; thence southerly to bound begun at.

Also conveying as an appurtenance to the "Brownell Lots" a right-of-way by foot or with vehicle for purposes of ingress and egress over the Dicey Lot, so-called, from the Washburn Road, so-called.

EXCEPTING from the aforementioned "Brownell Lots" located in Alexandria, the following:

1) All of Tax Map 410, Lot 16-2, being a ten (10) acre lot, more or less, located at 1165 Washburn Road, Alexandria, New Hampshire; and

2) All of Tax Map 21, Lot 21-1, being a 7.1 acre lot, more or less situated on Washburn Road, Alexandria, New Hampshire.

"Robbins Lots"

TRACTS IN DANBURY

Certain tracts or parcels of land with any improvements thereon situated in Danbury in the County of Merrimack and State of New Hampshire, bounded and described as follows:

TRACT #1: Commencing at the Town line between Danbury and Grafton at the corner of land now or formerly of one Sulloway; thence northerly by said Town line to land now or formerly owned by Dexter Perkins; thence southerly by land now or formerly of said Perkins to the range line; thence southerly by the range line to land now or formerly owned by C. A. and G. M. Sulloway; thence northerly to the first mentioned bound, said premises being known as the old Tinkham place.

Reference is made to the deed from Florence E. Barrett to G. Wesley Sulloway dated August 23, 1957, duly recorded.

TRACT #2: Containing by estimate thirty acres, more or less, and bounded and described as follows: Bounded northerly and easterly by land supposed to be owned now or formerly by George W. Sawing of Grafton; southerly by the Hale Mountain pasture, so-called, and westerly by the highway leading to the Hopper, so called, in said Danbury.

TRACT #3: Commencing at a stake and stones at the North corner of said lot on the Grafton Town Line; thence South on the Grafton Town Line to land now or formerly owned by Sulloway

Heirs; thence southeasterly on land of Sulloway Heirs to the old highway; thence northerly on said highway to the Tinkham land, so-called; thence northwesterly on said Tinkham land to the first mentioned bound.

TRACT #4: Bounded westerly by land now or formerly of Cyrus A. and the heirs of Gilbert M. Sulloway; northerly and easterly by land now or formerly of Cyrus A. Sulloway and the heirs of Gilbert M. Sulloway and W. Cornell; easterly by land now or formerly of said Cornell and land formerly of John C. Pillsbury; southerly and westerly by land formerly of said Pillsbury and land now or formerly of George S. Tenney, the premises known as the Eastman Place.

TRACT #5: Westerly by the Grafton Town line; thence northerly by the land of the Sulloway heirs to the Eastman Road, so-called; thence by said Eastman Road to land formerly owned by John W. Pillsbury; southerly and westerly by land now or formerly owned by Lewis M. Bean to point of beginning.

Reserving the Town Highway through the above-described premises formerly called the Hopper Road. Also reserving a mining right in the Sanborn Pasture, so-called.

TRACT #6: Westerly by the Grafton Town Line; southerly by land formerly owned by William H. Burleigh and land formerly owned by Lucien Follansbee; easterly and northerly by said Follansbee's land and land now or formerly owned by I. B. Sargent, Peter Kimball and Nicanor Heath.

"Brownell Lots"

Tract #1

Certain tracts or parcels of land situated in Danbury, County of Merrimack, State of New Hampshire and being Lot #10 and Lot #46 as said lots are shown and laid out on the original lay-out or plan of the Town of Danbury.

Tract #2

A certain tract of land situated in said Danbury, bounded and described as follows, to wit:

Commencing at the southeast corner of Lot No. 46, thence northerly on the east side line of said Lot No. 46 about forty (40) rods to a corner at stake and stones; thence westerly about eighty (80) rods on a straight line to a stake and stones standing on the west line of said lot and parallel with the east side line about forty (40) rods to the southerly line of said Lot No. 46; thence easterly along the south line of said lot eighty (80) rods (said south line supposed to be the range line) to the point of beginning.

Also all of the mineral or inning rights appurtenant to a certain tract of land situated in said Danbury, bounded and described as follows, to wit:

Easterly and northerly by the Alexandria Town Line, westerly land of Dan Braley and Catherine Braley; and southerly by the Rolf Lot, so-called; being known as the I. H. Bailey homestead and being the easterly half of Lot #10. Containing one hundred acres.

Reference is made to deed of Standard Mica to Errol Perkins dated February 19, 1914 and entered in Book 416, Page 133 of Merrimack County Records. Said mining rights were taken by said Town of Danbury for nonpayment of taxes owed by said Standard Mica Company for the years 1915, 1916, 1917 and 1918.

Also conveying as an appurtenance to the "Brownell Lots" a right-of-way by foot or with vehicle for purposes of ingress and egress over the Dicey Lot, so-called, from the Washburn Road, so-called.

MERRIMACK COUNTY RECORDS
Kathi L. Guay, CPO, Register

8051446
Tx:4045324

3980-0135
05/20/2013 1:44 PM Pages: 4
REGISTER OF DEEDS, GRAFTON COUNTY

Kelley J Monahan

E-276

NOTICE OF SECOND AMENDMENT TO WIND ENERGY LEASE AGREEMENT

NOTICE IS HEREBY GIVEN of a certain Second Amendment to Wind Energy Lease Agreement by and between the parties identified in this Notice dated as of May 10, 2013 ("Second Amendment"), of property owned by **H & H Investments, LLC** located in the Town of Grafton, Grafton County, New Hampshire, as follows:

LESSORS: **H & H Investments, LLC**
P.O. Box 519
Antrim, New Hampshire 03440

LESSEE: **Atlantic Wind, LLC,** an Oregon limited liability company, as successor in interest to Iberdrola Renewables USA, Ltd., a Delaware corporation
Two Radnor Corporate Center, Suite 200
100 Matsonford Road
Radnor, Pennsylvania 19087

PREMISES: An exclusive lease to the use of a portion of the Landlord's land and improvements located in the Town of Grafton, Grafton County, New Hampshire described in that certain deed from Sandra Pierson and Nathan Coronis to H & H Investments, LLC, which deed is dated February 4, 2013 and recorded in the Grafton County Registry of Deeds at Book 3955, Page 695. The premises in the above-named deed is further identified on EXHIBIT A attached to this Notice.

TERM: The Development Period of the Second Amendment shall be the same as that under the Wind Energy Lease dated June 8, 2009 (Notice of which is recorded in the Grafton County Registry of Deeds at Book 3629, Page 814, and the Merrimack County Registry of Deeds at Book 3139, Page 702), five (5) years with a renewal term of 2 years. The Extended Term of the Lease is twenty-five (25) years beginning on the Commencement of Construction as defined in the Lease, with two (2) renewals terms of ten (10) years each.

LESSORS:

H & H INVESTMENTS, LLC

By:____________________________
Teresa J. Hardwick, Member
Duly authorized

STATE OF NEW HAMPSHIRE
COUNTY OF Hillsborough

The foregoing instrument was acknowledged before me this 24th day of April 2013, by Teresa J. Hardwick, a duly authorized Member of H & H Investments, LLC, a New Hampshire limited liability company, on behalf of the said company.

____
Notary Public/Justice of the Peace
Print Name: Kristie Laplante
My Commission Expires: KRISTIE J. LAPLANTE, Notary Public
My Commission Expires March 24, 2015

LESSEE:

ATLANTIC WIND, LLC

By:____________________
Name: Rany Raviv
Title: Authorized Representative
Duly authorized

By:____________________
Name: Mark Epstein
Title: Authorized Representative
Duly authorized

COMMONWEALTH/STATE OF Oregon
COUNTY OF Multnomah

The foregoing instrument was acknowledged before me this 10th day of May 2013, by Rany Raviv, a duly authorized Representative of Atlantic Wind, LLC, on behalf of the said limited liability company.

OFFICIAL SEAL
AHNYAH D KRUMMENACKER
NOTARY PUBLIC-OREGON
COMMISSION NO. 463239
MY COMMISSION EXPIRES NOVEMBER 01, 2015

Ahnyah D. Krummenacker
Notary Public/Justice of the Peace
Print Name: Ahnyah D. Krummenacker
My Commission Expires: November 1, 2015

COMMONWEALTH/~~STATE~~ OF PA
COUNTY OF Delaware

The foregoing instrument was acknowledged before me this 8 day of May 2013, by Mark Epstein, a duly authorized Representative of Atlantic Wind, LLC, on behalf of the said limited liability company.

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
JAMIE WHITE, Notary Public
Radnor Twp., Delaware County
My Commission Expires September 26, 2015

Notary Public/~~Justice of the Peace~~
Print Name: Jamie White
My Commission Expires: 9-26-15

EXHIBIT A

TO

SECOND AMENDMENT TO WIND ENERGY LEASE AGREEMENT
BETWEEN
H&H INVESTMENTS, LLC
AND
ATLANTIC WIND, LLC
DESCRIPTION OF PROPERTY

A certain tract or parcel of land, with any improvements thereon, located in the Town of Grafton, County of Grafton and State of New Hampshire, situated off of Gifford Road and shown on the Town of Grafton Tax Map Parcel, Map 7, Lot #1168 (.9 acre more or less).

Meaning and intending to describe the property conveyed to H & H Investments, LLC by deed of Sandra Pierson and Nathan Coronis, which deed is dated February 4, 2013 and recorded in the Grafton County Registry of Deeds at Book 3955, Page 695.

8018911
Tx:4016685

3930-0974
11/08/2012 12:47 PM Pages: 6
REGISTER OF DEEDS, GRAFTON COUNTY

Kelley J Monahan

RETURN TO:
PIERCE ATWOOD LLP
MERRILL'S WHARF
254 COMMERCIAL STREET
PORTLAND, ME 04101

271

NOTICE OF WIND ENERGY LEASE AGREEMENT

NOTICE IS HEREBY GIVEN of a certain Wind Energy Lease Agreement by and between the parties identified in this Notice, of property owned by **Michael B. Oeschger** located in the Town of Alexandria in Grafton County, New Hampshire, as follows:

LESSORS: **Michael B. Oeschger**
380 Lakeview Heights
Alexandria, NH 03222

LESSEE: **Atlantic Wind LLC**
Two Radnor Corporate Center, Suite 200
100 Matsonford Road
Radnor, PA 19087

PREMISES: An exclusive lease to the use of a portion of the Lessors' land and improvements located in the Town of Alexandria, in the County of Grafton, New Hampshire, described in that certain Warranty Deed from Hendrik Houthakker to Helen S. Kaye and Michael B. Oeschger, which deed is dated June 1, 2001 and recorded in the Grafton County Registry of Deeds at Book 2545, Page 503, said premises further identified on EXHIBIT A attached hereto.

TERM: The Development Period of the Lease shall be four (4) years with a renewal term of one (1) year. The Extended Term of the Lease is twenty-five (25) years beginning on the Commencement of Construction as defined in the Lease, with two (2) renewal terms of ten (10) years each.

LESSORS:

____
Michael B. Oeschger

STATE OF NEW HAMPSHIRE
COUNTY OF Grafton

On Oct 1, 2012 personally appeared the above-named Michael B. Oeschger and acknowledged the foregoing instrument to be his free act and deed.

____
Notary Public/Justice of the Peace
Print Name: Ann M. Rominger
My Commission Expires:______

ANN M ROMINGER
Notary Public, New Hampshire
My Commission Expires Oct 22, 2013

LESSEE:

ATLANTIC WIND LLC

By:____________________
Name: Rany Raviv
Title: Authorized Representative
Duly authorized

By:____________________
Name: Mark Epstein
Title: Authorized Representative
Duly authorized

COMMONWEALTH/STATE OF Oregon
COUNTY OF Multnomah

The foregoing instrument was acknowledged before me this 26 day of October 2012, by Rany Raviv, a duly authorized Representative of Atlantic Wind LLC, an Oregon limited liability company, on behalf of said Atlantic Wind LLC.

OFFICIAL SEAL
AHNYAH D KRUMMENACKER
NOTARY PUBLIC-OREGON
COMMISSION NO. 463239
MY COMMISSION EXPIRES NOVEMBER 01, 2015

Notary Public/~~Justice of the Peace~~
Print Name: Ahnyah D. Krummenacker
My Commission Expires: November 1, 2015

COMMONWEALTH/S~~TATE OF~~ Pennsylvania
COUNTY OF Delaware

The foregoing instrument was acknowledged before me this 16 day of Oct 2012, by Mark Epstein, a duly authorized Authorized Rep of Atlantic Wind LLC, an Oregon limited liability company, on behalf of said Atlantic Wind LLC.

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
JAMIE WHITE, Notary Public
Radnor Twp., Delaware County
My Commission Expires September 26, 2015

Notary Public/~~Justice of the Peace~~
Print Name: Jamie White
My Commission Expires: 9-26-15

<u>EXHIBIT A</u>

Legal Description

Certain land and premises located in the Town of Alexandria, County of Grafton and State of New Hampshire and described as follows:

Being Lot 15, containing 682 acres, more or less, as depicted on a survey map entitled "Lands of A. James Grace, Estate Lots, Eastman Hill Road, Alexandria, New Hampshire" dated September 20, 1988 with a revision dated February 1, 1989, drawn by Courcelle Surveying Company and recorded as Plan No. 5507 in the Grafton County Registry of Deeds, and further described as follows:

Beginning at an 8" blazed Spruce tree marking the northeasterly corner of the conveyed land and premises and the southeasterly corner of Lot No. 14;

Thence running S 07° 15' E a distance of 1997.0 feet crossing Eastman Hill Road along lands now or formerly of Stefaniak Gardner to a stone monument;

Thence following a crooked blazed line S 03° 30' W a distance of 3087.5 feet crossing an existing wood road along lands now or formerly of Stone to a stone monument;

Thence S 07° 30' E a distance of 2210.5 feet, as per Howard survey crossing an existing wood road along the lands now or formerly of Patten Corporation to a stone monument;

Thence turning and running S 57° 00' W a distance of 2229.0 feet crossing Pine Hill Brook to a stone monument;

Thence S 55° 00' W a distance of 1113.0 feet to a stone monument;

Thence S 54° 30' W a distance of 1131.0 feet to a 12" blazed Spruce tree marking the southwesterly corner of the within conveyed lands;

Thence turning and running N 05° 15' W a distance of 7659.5 feet, more or less, along lands now or formerly of Yorkshire Timber to an unmarked boundary point;

Thence turning and running N 62° 45' E a distance of 4550.0 feet along Lot No. 14 and crossing Eastman Hill Road to the point and place of beginning.

Said parcel to contain 682 acres, more or less.

The above described lands and premises are subject to such other easements and rights-of-way of record as may affect them.

There is also a right-of-way herein conveyed to the Grantee from said tract over land and bounded and described as follows:

Beginning at an intersection of Eastman Hill Road and Newfound Hills Road and thence proceeding easterly and southerly along Newfound Hills Road following courses depicted on a Plan entitled "Subdivision of a portion of lands of A. James Grace Newfound Hills, Alexandria, New Hampshire" prepared by Courcelle Surveying Company, dated November 7, 1988, with revision dates of January 5, 1989 and February 1, 1989 and recorded in the Grafton County Registry of Deeds as Plan No. 5508, to a point, said point is located in the centerline of said Newfound Hills Road being N 69° 04' 45" W a distance of 25.0 feet from an iron pin marking the northerly corner of Lot No. 3 of the before-mentioned subdivision;

Thence following an existing wood road, more or less, in the following courses:

S 20° 55' 15" W a distance of 126.76 feet to a point;

S 17° 29' 15" W a distance of 145.37 feet to the P.C. of a curve to the right;

Thence following the curve to the right with a radius of 294.71 feet and arc distance of 125.32 feet to a point;

Thence following a curve to the left with a radius of 331.81 feet and an arc distance of 154.45 feet to a point;

Thence following a curve to the right with a radius of 205.82 feet and an arc distance of 200.53 feet to a point;

Thence following a curve to the left with a radius of 475.18 feet and an arc distance of 71.81 feet to a point;

Thence following a curve to the right with a radius of 191.35 feet and an arc distance of 127.41 feet to a point;

Thence N 82° 00' 15" W a distance of 256.05 feet to a point;

Thence N 70° 42' 00" W a distance of 81.85 feet to a point marking the intersection of two existing wood roads;

Thence S 15° 23' 45" E a distance of 124.23 feet to a point;

Thence S 30° 21' 45" E a distance of 143.07 feet to a point marking the P.C. of a curve;

Thence following a curve to the right with a radius of 46.00 feet and an arc distance of 64.11 feet to a point;

Thence S 49° 29' 15" W a distance of 185.51 feet to a point;

Thence S 53° 13' 00" W a distance of 197.60 feet to a point;

Thence S 47° 46' 00" W a distance of 66.10 feet to a point located N 58° 31' 30" W a distance of 24.55 feet from a marked 8" Spruce tree.

The above described Right-Of-Way is to be 25 feet on each side of the above described centerline.

2.2 Copy of the Application Fee (check)

HORIZONS ENGINEERING INC
34 SCHOOL ST
LITTLETON, NH 03561
PH 603-444-4111

1372
58-7477/2116
21

11-22-2013
Date

Pay to the Order of Treasurer, State of NH $ 33,247.20

Thirty Three Thousand, Two Hundred Forty Seven 20/100 Dollars

Security Features Details on Back.

Passumpsic Savings Bank

For Wild Meadows AOT

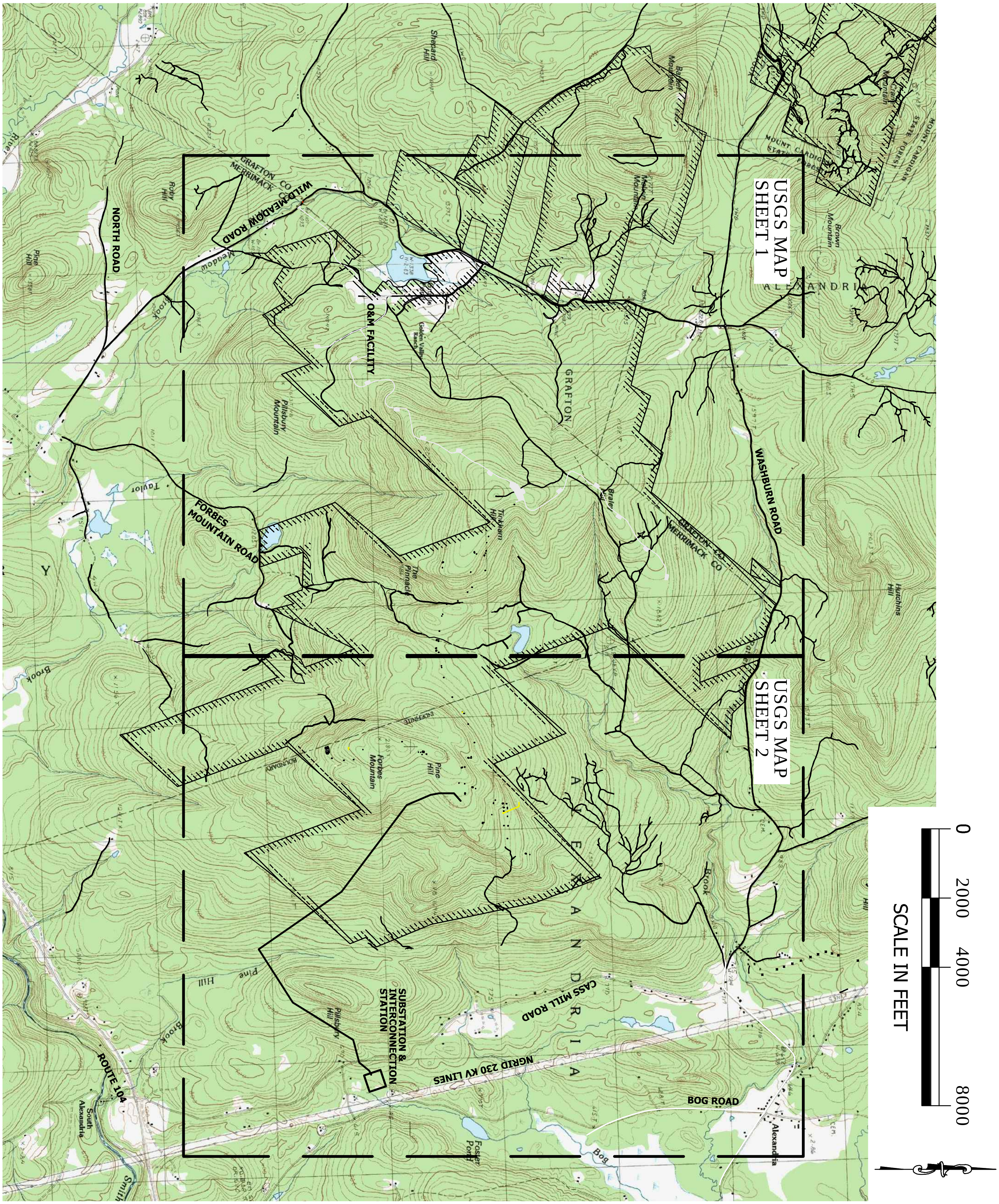
MP

⑆211674775⑆521800277O⑈ 1372

Harland Clarke

MAROON SHEFFIELD™

2.3 USGS Location Map



13185

IBERDROLA RENEWABLES

horizons Engineering Inc.

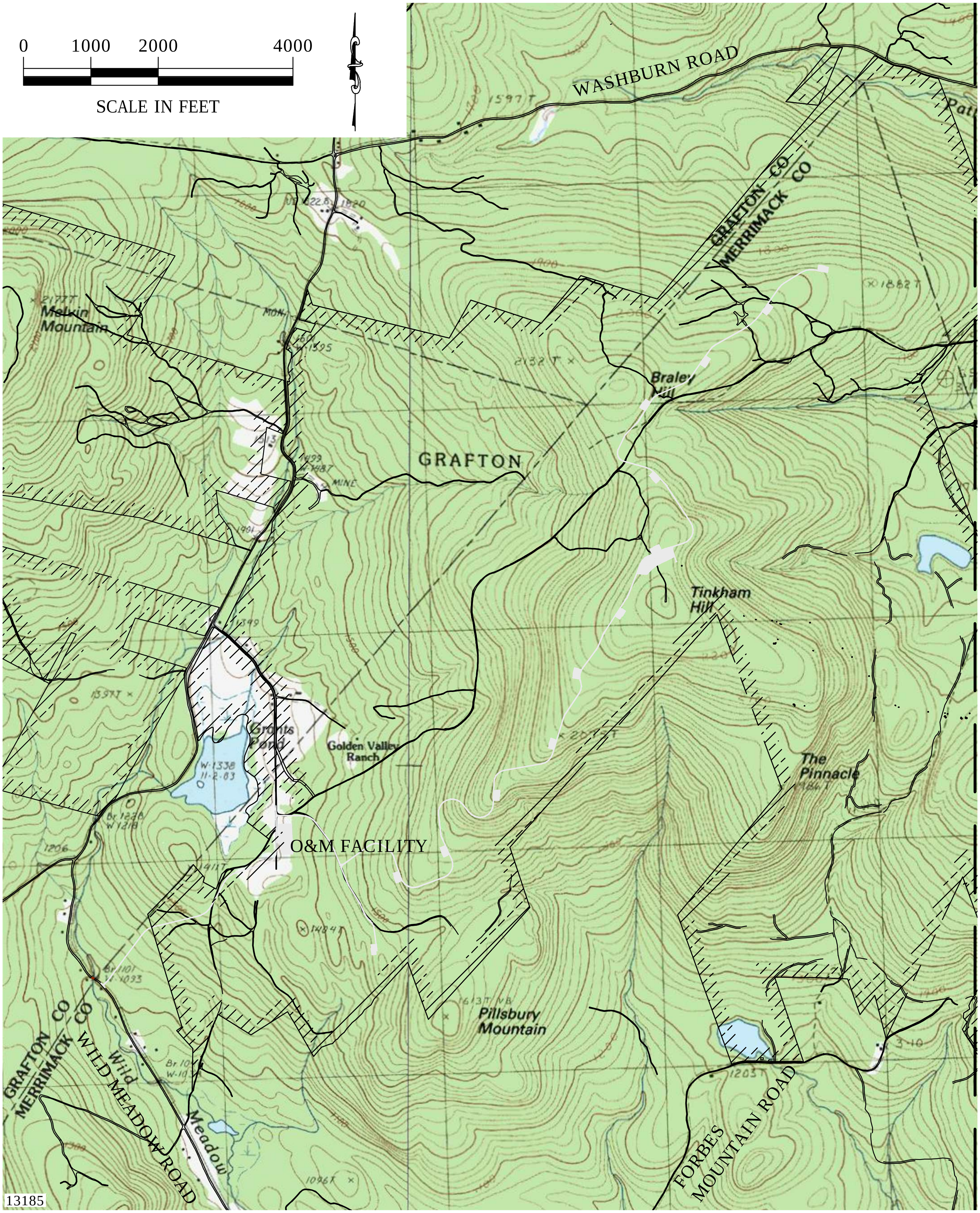
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

USGS MAP OVERALL

P:\13185 IRF12\DWGS\70 Percent\AOT-EXHIBITS_AERIAL_USGS.dwg, USGS 8x11-OVERALL, 12/5/2013 8:42:24 AM, chernick



IBERDROLA RENEWABLES

horizons Engineering Inc.

34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

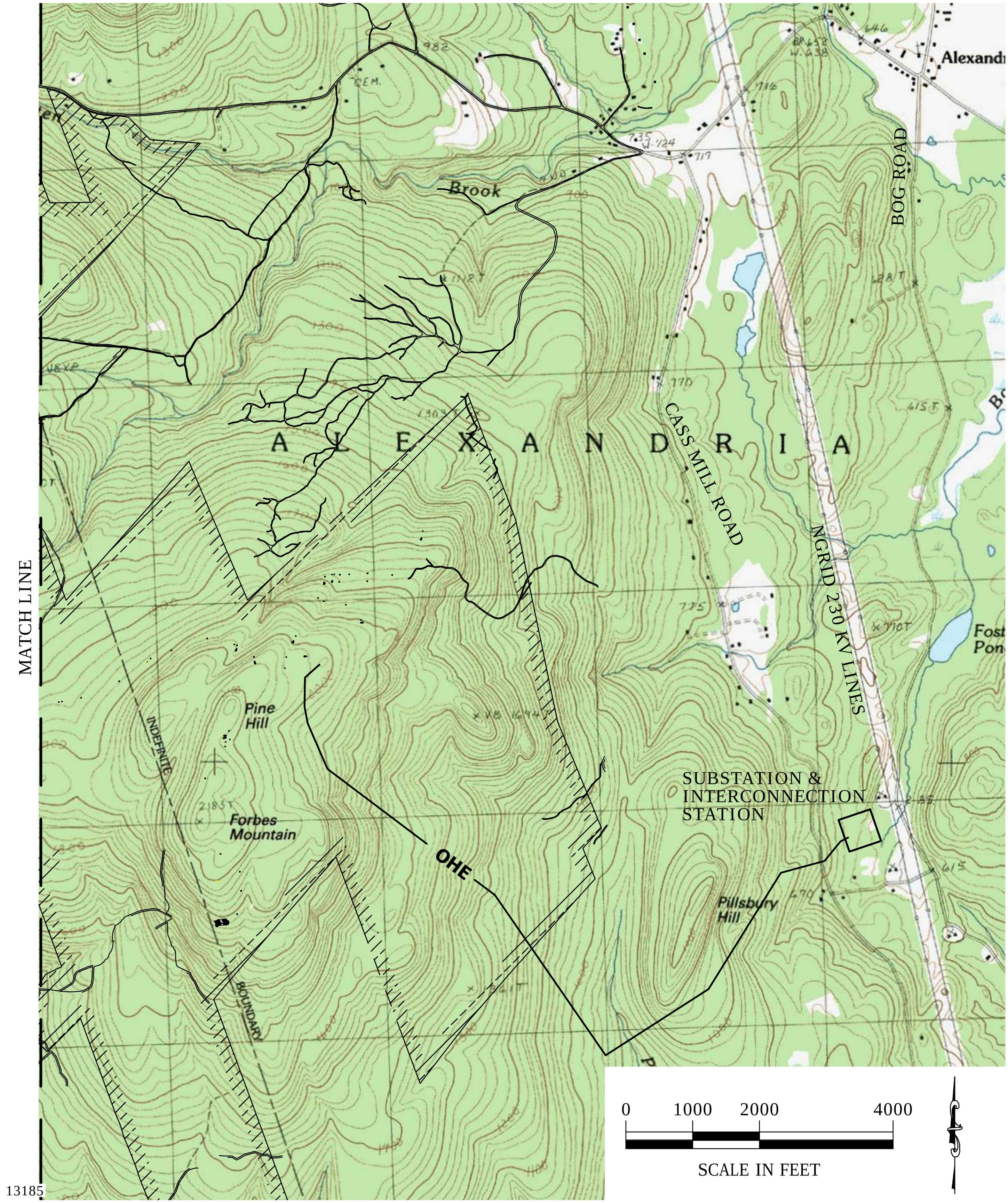
WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

USGS MAP
SHEET 1

P:\13185 IRF12\DWGS\70 Percent\AOT-EXHIBITS_AERIAL_USGS.dwg, USGS 8x11-(1), 12/5/2013 8:42:27 AM, chernick

P:\13185 IRF12\DWGS\70 Percent\AOT-EXHIBITS_AERIAL_USGS.dwg, USGS 8x11 (2), 12/5/2013 8:42:29 AM, chernick



IBERDROLA RENEWABLES

horizons Engineering Inc.

34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS
WIND PROJECT
ALEXANDRIA AND DANBURY, NH

USGS MAP
SHEET 2

2.4 Certified Mail Receipts

2.5 Application Check List

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF ENVIRONMENTAL SERVICES
LAND RESOURCES MANAGEMENT
ALTERATION of TERRAIN BUREAU
29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
Phone: (603) 271-2147 Fax: (603) 271-6588
Website: http://des.nh.gov/organization/divisions/water/aot/index.htm
For Permit Status: http://www2.des.state.nh.us/OneStop/Wastewater_Engineering_Site_Specific_Query.aspx

ATTACHMENT A:
ALTERATION OF TERRAIN PERMIT APPLICATION CHECKLIST

Check the box to indicate the item has been provided or provide an explanation why the item does not apply.

DESIGN PLANS

☒ Plans printed on 34 - 36” by 22 - 24” white paper

☒ PE stamp

☒ Wetland delineation

☒ Temporary erosion control measures

☒ Treatment for all stormwater runoff from impervious surfaces such as roadways (including gravel roadways), parking areas, and non-residential roof runoff. Guidance on treatment BMPs can be found in Volume 2, Chapter 4 of the NH Stormwater Management Manual.

☒ Pre-existing 2-foot contours

☒ Proposed 2-foot contours

☐ Drainage easements protecting the drainage/treatment structures

☒ Compliance with the Wetlands Bureau, RSA 482- A http://des.nh.gov/organization/divisions/water/wetlands/index.htm. Note that artificial detention in wetlands is not allowed.

☒ Compliance with the Comprehensive Shoreland Protection Act, RSA 483-B. http://des.nh.gov/organization/divisions/water/wetlands/cspa

☐ Benches. Benching is needed if you have more than 20 feet change in elevation on a 2:1 slope, 30 feet change in elevation on a 3:1 slope, 40 feet change in elevation on a 4:1 slope.

☐ Check to see if any proposed ponds need state Dam permits. http://des.nh.gov/organization/divisions/water/dam/documents/damdef.pdf

DETAILS

☒ Typical roadway x-section

☒ Detention basin with inverts noted on the outlet structure

☒ Stone berm level spreader

☒ Outlet protection – riprap aprons

☒ A general installation detail for an erosion control blanket

☒ Silt fences or mulch berm

☐ Storm drain inlet protection. Note that since hay bales must be embedded 4 inches into the ground, they are not to be used on hard surfaces such as pavement. *N/A*

☒ Hay bale barriers

☒ Stone check dams

☒ Gravel construction exit

☒ The treatment BMP's proposed

☐ Any innovative BMP's proposed *N/A*

CONSTRUCTION SEQUENCE/EROSION CONTROL

☒ Note that the project is to be managed in a manner that meets the requirements and intent of RSA 430:53 and Chapter Agr 3800 relative to invasive species.

☒ Note that perimeter controls shall be installed prior to earth moving operations

☒ Note that ponds and swales shall be installed early on in the construction sequence (before rough grading the site)

☒ Note that all ditches and swales shall be stabilized prior to directing runoff to them

☒ Note that all roadways and parking lots shall be stabilized within 72 hours of achieving finished grade

☒ Note that all cut and fill slopes shall be seeded/loamed within 72 hours of achieving finished grade

☒ Note that all erosion controls shall be inspected weekly AND after every half-inch of rainfall

☒ Note the limits on the open area allowed, see Env-Wq 1505.02 for detailed information

Example note: The smallest practical area shall be disturbed during construction, but in no case shall exceed 5 acres at any one time before disturbed areas are stabilized

☒ Note the definition of the word "stable"

Example note: An area shall be considered stable if one of the following has occurred:

- Base course gravels have been installed in areas to be paved
- A minimum of 85 percent vegetated growth has been established
- A minimum of 3 inches of non-erosive material such stone or riprap has been installed
- Or, erosion control blankets have been properly installed.

☒ Note the limit of time an area may be exposed
Example note: All areas shall be stabilized within 45 days of initial disturbance

☒ Provide temporary and permanent seeding specifications. (Reed canary grass is listed in the Green Book; however, this is a problematic species according to the Wetlands Bureau and therefore should not be specified)

☒ Provide winter construction notes that meet or exceed our standards.

Standard Winter Notes:

- All proposed vegetated areas that do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized by seeding and installing erosion control blankets on slopes greater than 3:1, and seeding and placing 3 to 4 tons of mulch per acre, secured with anchored netting, elsewhere. The installation of erosion control blankets or mulch and netting shall not occur over accumulated snow or on frozen ground and shall be completed in advance of thaw or spring melt events.

- All ditches or swales which do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized temporarily with stone or erosion control blankets appropriate for the design flow conditions.

- After November 15, incomplete road or parking surfaces, where work has stopped for the winter season, shall be protected with a minimum of 3 inches of crushed gravel per NHDOT item 304.3.

☐ Note at the end of the construction sequence that "Lot disturbance, other than that shown on the approved plans, shall not commence until after the roadway has the base course to design elevation and the associated drainage is complete and stable". – This note is applicable to single/duplex family subdivisions, when lot development is not part of the permit. *N/A*

DRAINAGE ANALYSES

Please double-side 8 ½" x 11" sheets where possible but, **do not** reduce the text such that more than one page fits on one side.

☒ PE stamp

☒ Rainfall amount obtained from the Northeast Regional Climate Center- http://precip.eas.cornell.edu/. Include extreme precipitation table as obtained from the above referenced website.

☒ Drainage analyses, in the following order:

- Pre-development analysis: Drainage diagram
- Pre-development analysis: Area Listing and Soil Listing
- Pre-development analysis: Node listing 1-year (if applicable), 2-year, 10-year and 50-year
- Pre-development analysis: Full summary of the 10-year storm
- Post-development analysis: Drainage diagram
- Post-development analysis: Area Listing and Soil Listing
- Post-development analysis: Node listing for the 2-year, 10-year and 50-year
- Post-development analysis: Full summary of the 10-year storm

☒ Review the Area Listing and Soil Listing reports

- Hydrologic soil groups (HSG) match the HSGs on the soil maps provided
- There is the same or less HSG A soil area after development (check for each HSG)
- There is the same or less "woods" cover in the post-development
- Undeveloped land was assumed to be in "good" condition
- The amount of impervious cover in the analyses is correct

Note: A good check is to subtract the total impervious area used in the pre analysis from the total impervious area used in the post-analysis. For residential projects without demolition occurring, a good check is to take this change in impervious area, subtract out the roadway and divide the remaining by the number of houses/units proposed. Do these numbers make sense?

☒ Check the storage input used to model the ponds

☒ Check to see if the artificial berms pass the 50-year storm, i.e., make sure the constructed berms on ponds are not overtopped

☒ Check the outlet structure proposed and make sure it matches that modeled

☒ Check to see if the total areas in the pre and post analyses are same

☒ Confirm the correct NRCS storm type was modeled (Coos, Carroll & Grafton counties are Type II, all others Type III)

PRE AND POST-DEVELOPMENT DRAINAGE AREA PLANS

☒ Plans printed on 34 - 36” by 22 - 24” on white paper

☒ Submit these plans separate from the soil plans

☒ A north arrow

☒ A scale

☒ Labeled subcatchments, reaches and ponds

☒ Tc lines

☒ A clear delineation of the subcatchment boundaries

☒ Roadway station numbers

☒ Culverts and other conveyance structures

PRE AND POST-DEVELOPMENT COLOR-CODED SOIL PLANS

☒ 11” x 17”sheets suitable, as long as it is readable

☒ Submit these plans separate from the drainage area plans

☒ A north arrow

☒ A scale

☒ Name of the soil scientist who performed the survey and date the soil survey took place

☒ 2-foot contours (5-foot contours if application is for a gravel pit) as well as other surveyed features

☒ Delineation of the soil boundaries and wetland boundaries

☒ Delineation of the subcatchment boundaries

☒ Soil series symbols (e.g., 26)

☒ A key or legend which identifies each soil series symbol and its associated soil series name (e.g., 26 = Windsor)

☒ The hydrologic soil group color coding (A = Green, B = yellow, C= orange, D=red, Water=blue, & Impervious = gray)

Please note that excavation projects (e.g., gravel pits) have similar requirements to that above, however the following are common exceptions/additions:

☐ Drainage report is not needed if site does not have off-site flow. *N/A*

☐ 5 foot contours allowed rather than 2 foot. *N/A*

☐ No PE stamp needed on the plans *N/A*

☐ Add a note to the plans that the applicant must submit to the Department of Environmental Services a written update of the project and revised plans documenting the project status every five years from the date of the Alteration of Terrain permit. *N/A*

☐ Add reclamation notes. *N/A*

See NRCS publication titled: *Vegetating New Hampshire Sand and Gravel Pits* for a good resource, it is posted online at: http://des.nh.gov/organization/divisions/water/aot/documents/vegetating-nh.pdf .

2.6 Project Narrative

2.6.1A Project Summary

Atlantic Wind, LLC is applying for an Alteration of Terrain (AOT) permit from New Hampshire Department of Environmental Services (NHDES) for a commercial wind farm project located in the town of Alexandria, New Hampshire on Tax Map 414, Lot 144, Tax Map 415, Lot 5, Tax Map 417, Lots 4, 8, 13, 43 and Danbury, New Hampshire, on Tax Map 401, Lot 1, Tax Map 403, Lots 9, 19, 20, and 25. The project will consist of 23 wind turbines, 9 miles of access roads, an electrical substation, 10 miles of electrical distribution lines, and an operations and maintenance facility. The total disturbance for this work is 151.5 acres. Including disconnected impervious surfaces, the total proposed impervious area is 30.65 acres.

To aid in the review of this application, we have broken the project into three components; the overall, the Substation/Interconnection Site and the Operations and Maintenance Site. They have been labeled as A, B and C respectively, with each component having its own narrative as well as supporting documentation.

The following table shows the 2, 10 and 50 year peak flow rate comparison at the discharge points.

Table 2.0A – 2, 10 and 50 Year Comparison

Watershed Area Discharge Point	Pre 2 Yr Flow Rate (cfs)	Post 2 Yr Flow Rate (cfs)	Pre 10 Yr Flow Rate (cfs)	Post 10 Yr Flow Rate (cfs)	Pre 50 Yr Flow Rate (cfs)	Post 50 Yr Flow Rate (cfs)
AP1	421.3	421.0	1234.2	1233.2	2751.5	2749.2
AP2	79.7	80.0	246.5	247.3	559.3	561.0
AP3	0.4	0.4	7.6	7.6	63.3	63.2
AP4	1.0	0.9	15.0	14.8	77.1	76.2
AP5	3.3	3.2	39.3	38.1	147.9	143.3
AP6	66.9	67.5	179.4	181.0	379.5	382.9
AP7	18.8	18.8	50.5	50.4	106.8	106.6
AP8	74.7	74.6	200.1	199.9	423.8	423.1
AP9	230.9	230.9	646.6	646.6	1397.8	1398.2
AP10	281.4	281.4	869.0	869.0	1973.8	1973.8

Impacts to watershed water quality from development within the watersheds can occur from uncontrolled discharge of site runoff during construction activities and stabilized developed surfaces once construction is complete.

Stormwater runoff will be controlled during construction through the use of various sediment and erosion control Best Management Practices (BMPs) that have been proven on sites similar to this project. Frequent monitoring by a qualified individual will enable an adaptable approach of implementation that is well suited to the changing conditions found during construction. Conceptual level erosion controls have been shown on the project plans at this time (for instance silt fence extents have been shown, but not sediment fence pockets or other refinements). Once a contractor has been selected and scheduling, sequence, means, and methods are known a detailed and unified plan (that incorporates agency comments) for managing construction related stormwater will be developed in the form of a Stormwater Pollution Prevention Plan (SWPPP) and submitted to DES for review.

After a project has been constructed stormwater runoff from impervious surfaces can contain a wide range of non-point source pollutants. Depending on the activity and use of the impervious surface these pollutants might include sediments, metals, nutrients, oils and greases, temperature, chlorides, bacteria, pH, and others. The Alteration of Terrain (AoT) stormwater treatment standards are intended to ensure that stormwater runoff that may contain many of these potential pollutants are captured and treated to remove the pollutants. The concentration of certain pollutants found in stormwater running off of paved roadways often correlates positively to the intensity of use (a higher number of vehicles trips per day generates a higher load of pollutants). In this wind project, once construction is completed, the amount of traffic on the roadways and pads is anticipated to be extremely low and therefore we anticipate few if any vehicular related pollutants to be present in the runoff from these roadways and pads. Instead, it is anticipated that the primary potential pollutants that might be found in stormwater running off of the roadways and pads are sediments (TSS), as well as some potential for increasing the temperature of runoff due to the removal of trees that would otherwise shade these surfaces, changing albedo, and the mass of the rock that surfaces the roadways and pads.

This project proposes the construction of a number of roadways and wind turbine pads with a gravelly surface that will be used to facilitate the construction and erection of wind turbines. After construction is complete a portion of these surfaces will be covered by organic material and vegetated with grasses, leaving a 16’ wide road and a reduction in the footprint of gravelly wind turbine pad. This reduction of gravelly surface has a dual advantage of minimizing the impervious surface that can generate runoff as well as providing a grass buffer through which runoff enters and coarse sediment particles are settled. On steeper roadways (over 7.5%) where a 40 foot wide construction road is reduced to 16 feet, the flow length of runoff through grass buffers meets AoT roadway buffer standards. On flatter and narrower roadways treatment swales have been proposed, and they meet treatment swale standards. As detailed later in the report runoff from the O&M facility and the substation will be treated using sand filters, a micro-pool extended detention pond and a treatment swale; are all sized per AoT standards.

In portions of the site where the above treatment devices cannot be constructed without significantly increasing the area of disturbance, increasing ponded runoff temperatures, or are prohibited by AoT rules due to steepness, a treatment alternative has been incorporated into the design to focus on the potential pollutants of concern (sediment and temperature). Over 100 sediment traps have been strategically located to collect and store concentrated runoff and allow sediment particles to be settled and trapped. Because of the sediment trap sump, runoff trapped within the sump will be assimilated into the ground where it will cool and add to the local water table. During larger storms once the runoff fills the trap, the cleanest treated water within the trap (at the water surface) will disperse out of the trap onto the forest floor where leaf litter will further polish the water by trapping the fine particles, and thereby lessening the chance for turbid water to enter wetlands or a stream. These sediment traps have worked effectively at other locations with similar potential pollutants and site constraints and because of their dispersed nature they have the benefit of: being efficiently sized to avoid additional tree clearing, are often shaded (reducing runoff temperature increases), are easily maintained, and help sustain local groundwater tables. These sediment traps effectively address the more limited range of anticipated pollutants when compared to other traditional forms of treatment, while avoiding the thermal impacts of expansive ponded treatment measures and thus provide a superior alternative. As not all impervious surfaces within the project will be treated using detention ponds or other large centralized treatment devices a waiver request has been submitted with this application to allow suitable alternatives that treat runoff for the applicable pollutants of concern in a dispersed manner and without incurring the negative environmental consequences of traditional treatment devices.

2.6.2A Existing Site Conditions

The project is located on 11 parcels of land in the towns of Alexandria and Danbury, New Hampshire. The project site is dominated by two main forested ridgelines on which the wind turbines will be situated. The ridges are characterized by steep slopes with glacial till and boulders with some bedrock outcrops. Land cover is predominantly an industrial forest with ongoing timber harvesting operations unrelated to the wind power project. Various hardwood species make up the majority of the hill slope forest with patches of spruce on some hill tops. Elevations within the project area range from approximately 600 to 2,300 feet. A drainage divide runs along the ridges , with lands within the project draining to the north to Patten Brook, a tributary of Bog Brook in the Newfound Lake watershed, and lands to the south of the divide draining to Wild Meadow Brook or other tributaries of Smith Brook in the Smith Brook watershed.

2.6.3A Proposed Site Conditions & Disturbances

Approximately 141 acres of earth disturbance will be required to construct the access roads, wind turbine pads, crane assembly areas, staging areas, the substation, the operation and maintenance facility and other electrical distribution infrastructure on the site. This work will include installing stormwater collection and treatment systems. Per NH Site Evaluation Committee (SEC) objectives this project has been sited in areas that have undergone extensive logging and will temporarily utilize certain existing logging roads during construction and thereby lessen the amount of new earth disturbance. An area of disturbance breakdown has been shown in **Table 2.1A**. Note that earth disturbance for the Substation/Interconnection Site, and for the Operations and Maintenance area are shown in **Tables 2.1B** and **2.1C**, respectively.

Table 2.1A – Proposed Disturbance Area Breakdown

	Construction/Disturbance Activity	Area (SF)	% EIC*	% UDC*
A	Total Drainage Area (the Project Watershed)	308,621,046		
B	Existing Unchanged Impervious Cover (within Project Watershed)	2,729,311		
C	Existing Unchanged Non-Impervious Disturbance	3,210,546		
D	Existing Unchanged Disturbance (B+C)	5,939,857		
E	Project Impervious Cover (Permanent Roadways and Wind Turbine Crane Pads)	1,144,187		
F	Project Non-Impervious Slope Grading and Site Disturbance	5,025,036		
G	Total Project Disturbance (E+F)	6,169,223		
H	Total Project and Existing Impervious Cover (B+E)	3,873,498	1.26%	
I	Total Disturbance (within Project Watershed) (D+G)	12,109,080		
J	Total Undisturbed Area (within Project Watershed) (A-I)	296,511,965		96.08%

** EIC = Effective Impervious Cover*
** UDC = Undisturbed Cover*

The impacts to water quality during site development will be minimized by using erosion prevention techniques and sediment control measures. Frequent site inspections during construction are required during construction and directly following certain rainfall events to ensure erosion control devices are working properly. The project will obtain coverage under EPA's National Pollution Discharge Elimination System Construction General Permit (CGP) as the project will disturb over one acre of earth. A detailed strategy for managing construction related stormwater will be developed in a Stormwater Pollution Prevention Plan (SWPPP) consistent with EPA's 2012 CGP. Through extensive design efforts the project has been refined to avoid many of the wetlands and streams found onsite. Where feasible, buffers between disturbance areas and important resources have been provided to further protect the functions and values of these resources during construction.

The Alteration of Terrain (AoT) Rules are intended to not only protect wetlands and surface waters from potential impacts during construction, but also from non-point source pollutants that may emanate from a development project once the facility has been constructed and is operational. Unlike most development projects that require AoT permits, wind projects involve different construction techniques, materials, and operational usage that inherently minimizes many of the post construction related concerns that the AoT rules are intended to address. Specifically, roads and wind turbine pads are constructed with coarse materials that provide less impedance of precipitation and natural water and stormwater runoff flow paths. Unlike typical development projects, the roadway infrastructure of wind facilities receive relatively little traffic once the facility is operational. Because the intensity of vehicular traffic is positively correlated with the concentration of many non-point source pollutants found in runoff from roadways, wind facilities can be anticipated to generate fewer types of potential non-point source pollutants. The types of pollutants of concern are more akin to those that might be expected to occur from logging activities (i.e.: total suspended solids, and temperature). This project has been designed to first prevent the generation of such pollutants so that their entrainment in stormwater runoff is minimized. Because it is recognized that prevention will not entirely prevent the mobilization of these pollutants (for instance Tss) during more intense storms, the project has included many dispersed treatment measures to capture and treat such pollutants close to the point of runoff generation. The following design features have been incorporated into this project to meet the above-referenced objectives:

1. tree cutting needed to construct roadways and other wind facility infrastructure has been minimized by proposing a narrower roadway and pad footprint, thereby maximizing the amount of shading and minimizing the area subject to potential thermal increases; and
2. the areal extent of cut and fills have been minimized by allowing for steeper rock cuts, thereby lessening the surface area of soil that needs to be disturbed; and
3. areas of earth disturbance outside of the permanent 16' wide roadways and crane pad/access areas will be stabilized using grass or stone to prevent the mobilization of soils by rainfall and runoff, and in the case of grass, increase the shading and lessen the albedo of ground surfaces to minimize increases in the temperature of stormwater that travels over these surfaces in larger storm events; and
4. roadways have been limited to grades of 15% or less to minimize runoff velocities; and
5. roadway crowns will limit the distance that water travels down the gravel roadways thereby minimizing runoff concentration and erosive forces; and
6. grassed vegetative buffers will be established adjacent to 16 foot wide permanent roadways and crane pad/access areas (once the facility construction is complete) to receive and disperse runoff from roadways and trap sediments that do become entrained in larger storm events; and

7. grass and stone stabilized ditches will collect runoff that may be generated during larger storm events and convey the runoff in a stable channel, thus retarding the erosive forces of concentrated flow that may develop in larger storms; and
8. porous rock conveyances (termed “rock sandwiches”) will be used in certain select locations where roadways cross non-riverine wetlands and will serve to convey shallow groundwater flow in a dispersed manner to the downslope side of the roadway where flows can re-enter the ground, thereby minimizing disruptions of shallow groundwater flow regimes; and
9. culverts have been spaced at frequent intervals to allow for the dispersion of concentrated flows that may occur in ditches; and
10. sediment traps will be located at many of the culvert or ditch outlets and will serve to settle entrained sediment particles, return a portion of the stormwater flow back into the shallow groundwater, and disperse onto the adjacent forest floor that portion of the flow volume that is not attenuated in the sediment traps during larger storms; and,
11. treatment swales have been located in areas where flatter grades exist and will receive and settle sediments entrained in stormwater.

This approach of preventing erosion and thermal increases, minimizing disruption of flow regimes, and capturing sediments in areas where concentrated flows might develop, has been used successfully at wind facilities with similar or greater environmental sensitivities and we feel confident that this project incorporates highly functional mechanisms that are protective of the aquatic environment.

The substation and operation and maintenance facilities are located in flatter terrain that allows for the use of more traditional post-development stormwater controls and, therefore, these facilities will utilize sand filters, micropool extended detention, and treatment swales to minimize the generation of stormwater pollutants and treat those pollutants that may become conveyed in stormwater in treatment devices suited to the use of these facilities. A full description of the methods used at these two facilities can be found in sections 2.6B and 2.6 C, respectively.

A copy of the Stormwater Inspection and Maintenance Manual for all permanent stormwater management devices to be used at the site can be found in **Section 3.8** of this report.

2.6.4A Rainfall Data

Using SCS TR-20, run under HydroCAD Version 9.1 with Type III-24 hour rainfall events, pre- and post-development cover types and drainage paths were modeled to generate peak discharge rates. Rainfall events modeled have intensities described by data provided by the Northeast Regional Climate Center for nine representative locations throughout the project site. These data are tabulated in full in section 2.13 of this report with the values of the most conservative location summarized below in Table 2.2A.

Table 2.2A - Type III, 24 Hour Rainfall Depths for Project Site (43.581°N, 71.796°W)

Rainfall Event	Depth*
1-year	2.26”
2-Year	2.65”
10-Year	3.85”
50-Year	5.59”
100-Year	6.58”

** Rainfall depths from the Northeast Regional Climate Center Extreme Precipitation Tables, 24hr Storm “Extreme Precipitation Estimates”, http://precip.eas.cornell.edu, accessed 30 September 2013. See section 2.13*

2.6.5A Peak Runoff Control Requirement

The proposed project has been designed to utilize more porous material, extensive revegetation and minimize the disruption of natural flow path, with the intention of maintaining natural flow regimes and thereby minimizing the need for extensive clearing and grading for flow attenuation/mitigation measures (such as detention ponds) to attenuate the larger, less frequent rainfall events as required by Env-Wq 1507.06. **Table 2.3A** summarizes the stormwater runoff peak flow rate for the 10 and 50 year storm events.

Table 2.3A – 10 and 50 Year Comparison

Watershed Area Discharge Point	Pre 10 Yr Flow Rate (cfs)	Post 10 Yr Flow Rate (cfs)	Pre 50 Yr Flow Rate (cfs)	Post 50 Yr Flow Rate (cfs)
AP1	1234.2	1233.2	2751.5	2749.2
AP2	246.5	247.3	559.3	561.0
AP3	7.6	7.6	63.3	63.2
AP4	15.0	14.8	77.1	76.2
AP5	39.3	38.1	147.9	143.3
AP6	179.4	181.0	379.5	382.9
AP7	50.5	50.4	106.8	106.6
AP8	200.1	199.9	423.8	423.1
AP9	646.6	646.6	1397.8	1398.2
AP10	869.0	869.0	1973.8	1973.8

2.6.6A Channel Protection Requirement

NHDES surmises that stream channels are often shaped, over the long term, by bankfull storms (storms that occur, statistically, once every two years) and that while peak flows from larger less frequent storms (10 year and 50 year) may be attenuated in detention ponds, use of such flow attenuation features can lead to sustained periods of bankfull flows that on many stream types can have the undesirable effect of inundating adjacent riparian vegetation and possibly weakening its ability hold alluvium and other channel substrate. In some streams where the dominant form of natural bank stabilization is the roots and stems of riparian vegetation, unnaturally long periods of sustained bankfull flows can result in damage to these roots and stems and can lead to stream channel instability. To broadly address this concern DES has rules in Env-Wq 1507.05 to compare the existing 2 year storm flow peaks and volumes to those anticipated after development.

A number of small intermittent and perennial streams drain from the project area and are characterized by their steep rocky channels with bedrock often serving as the channel's grade control. Detailed site visits to such streams where project roads cross has found that such channels often have numerous small natural woody debris jams or significant leaf packs that raise the stage of the stream to its banks on a frequent basis. Where debris jams constrict flow it often causes frequent (but highly localized) bank stress. On moderately steep channels, some lateral channel migration can be seen due to this natural scour/deposition regime and where channels steepen bedrock outcroppings appear as grade controls. In short, stream stability on these steeper streams appears to be from the bouldery/ledgy substrate and banks, not due to riparian vegetation that would be impacted by prolonged inundation. Nonetheless, two year pre- and post-flows were analyzed at the 10 analysis points and show that, generally, the post-development peak flows were equal to those in the pre-developed condition. In the couple of instances where stream flows peaked slightly higher than in the pre-developed condition the duration of time that these flows exceed the pre-developed flow is less than 5 minutes. This combined with the naturally dynamic, but resilient steeper intermittent stream channels should not result in stream channel instability. Storm volumes at each analysis point are within the allowances of AoT Rules in all cases.

Table 2.4A shows the runoff from disturbed areas within the project limits at each of the analysis points. **Table 2.4A** shows that the stormwater runoff peaks, the duration that the peak exceeds the predevelopment peak (where applicable), and the volume of water associated with a 2 year storm at each of the 10 analysis points. As noted above, where insignificant increases in peaks occur it is for a very short duration and all analysis points the volume of increase meets the allowed 0.10 acre-foot increase specified in Env-Wq 1507.05 (b) (1) (a). Despite the increase in impermeable surface on site, the minimal changes in discharge values can be attributed to the revegetation of much of the disturbed surfaces, frequent culvert spacing and large tracts of forest that lie adjacent to project infrastructure.

Table 2.4A – Channel Protection Comparison Outlet Points

Outlet point	Pre 2 Yr Flow Rate (cfs)	Post 2 Yr Flow Rate (cfs)	Pre 2yr Vol. acre-feet (af)	Post 2yr Vol. acre-feet (af)	Duration Post Peak exceeds Pre Peak, 2yr storm (minutes)
AP1	421.3	421.0	107.46	107.37	Post < Pre
AP2	79.7	80.0	14.49	14.53	2 minutes
AP3	0.4	0.4	0.25	0.25	Post = Pre
AP4	1.0	0.9	0.61	0.60	Post < Pre
AP5	3.3	3.2	1.76	1.78	Post < Pre
AP6	66.9	67.5	10.76	10.86	4 minutes
AP7	18.8	18.8	2.88	2.87	Post = Pre
AP8	74.7	74.6	11.78	11.73	Post < Pre
AP9	230.9	230.9	41.97	42.06	Post = Pre
AP10	281.4	281.4	59.34	59.34	Post = Pre
Total	1178.4	1178.7	251.30	251.39	

2.6.7A Groundwater Recharge Volume

Under Env-Wq 1507.04, NHDES desires that a portion of the stormwater runoff be returned into the groundwater table to replenish groundwater resources by reducing the amount of water diverted off-site by the proposed development. As much of the site lies high on ridgelines with limited depth to impermeable soil stratum (ledge or glacial till) and correspondingly high seasonal high groundwater table, approaches to employ typical groundwater recharge features are limited. Steep slopes adjacent to such areas would prohibit centralized groundwater recharge features as many slopes exceed 15% and would require extensive cut in fills (and a disproportionately high amount of additional trees clearing and ground disturbance) to recharge runoff into the underlying native soils that have a limited capacity to infiltrate large amounts of runoff. Conversely, the substation, operation and maintenance facility, and laydown yard lie on flatter land with a higher potential for inducing groundwater recharge. In these lower areas, groundwater recharge facilities have been oversized (in the case of the operation and maintenance facility by over 1,000%) to compensate for the limited recharge opportunities higher on the ridgelines. As can be seen in **Table 2.5A** groundwater recharge standards for the project have met Env-Wq 1507.04.

Additionally, while not counted towards meeting groundwater recharge standards, and while the site conditions on the ridgelines limit traditional recharge structure design, the project has been designed to include over 100 distributed features along access roads and turbine pads that will help replenish local groundwater tables. These features are consistent with the overall approach of dispersed drainage that will serve to distribute groundwater recharge across the project site. With the understanding that the pollutants likely to be found in stormwater runoff from access roads and turbine pads are typically limited to sediments (and possibly increase in runoff temperature), pre-treating runoff prior to its entry into these dispersed features is not needed as volatiles or other potential groundwater pollutants will not likely be present in stormwater runoff from these access roads and turbine pads.

The dispersed features that will aid in maintaining or replenishing groundwater include:

porous rock slope and fill used to construct roadways and turbine pads;
use of rock sandwiches where roadways cross wetlands and culverts are not used; and,
a significant number of sediment traps constructed into the native ground where concentrated runoff can be captured, sediments settled, and the decanted runoff can access the shallow more permeable soils that lie at the periphery of, and surround, the upper portion of the sediment trap sump.

The amount of stormwater required to be infiltrated for this project is based on the hydrologic soil group of the soil beneath the proposed effective impervious surface. As described in waivers submitted for the project, hydrologic group soils have been determined based upon NRCS county soils surveys. All gravelly surfaces that are to remain after construction have been considered impervious and subject to groundwater recharge requirements. The amount of groundwater recharge required per soil group is summarized in **Table 2.5A**. Groundwater recharge is provided through surface sand filters as further described in sections 2.6.7B and C.

Table 2.5A – Groundwater Recharge Volume Comparison

HSG	Required Groundwater Recharge Depth (in)	Net Proposed Effective Impervious Area (Acres)	GRV Required by NHDES (cubic feet)	GRV Provided[1] (cubic feet)
A	0.40	0.33	474	
B	0.25	0.57	519	
C	0.10	15.04	5,458	
D	0.00	10.33	0	
Total		26.27	6,451	11,464

[1] GRV standards for the Overall project have been met at the O&M facility and Substation - see Sections 2.6.7B and 2.6.7C for details. Required GRV is 1,529 cubic feet total for the O&M and Substation facilities.

2.6B Project Narrative
Substation and Interconnection Station

2.6.1B Project Summary Substation and Interconnection Station

The project will require the installation of an electrical substation and an interconnection station, which is located in the town of Alexandria, NH, on Lot 63 Tax Map 417, along Bog Road. The site work will include a new 1,000 foot long, 16' wide gravel access road, a 160 foot by 170 foot gravel substation, and a 260 foot long by 180 foot wide gravel interconnection station. The stormwater design will include a micro extended detention pond, a surface sand filtration pond and a treatment swale. The calculated total disturbance for this site work is 232,218 square feet. The total proposed impervious (gravel) area is 92,783 square feet. The following table shows the 2, 10 and 50 year peak flow rate comparison at the discharge points.

Table 2.0B – 2, 10 and 50 Year Comparison

Watershed Area Discharge Point	Pre 2 Yr Flow Rate (cfs)	Post 2 Yr Flow Rate (cfs)	Pre 10 Yr Flow Rate (cfs)	Post 10 Yr Flow Rate (cfs)	Pre 50 Yr Flow Rate (cfs)	Post 50 Yr Flow Rate (cfs)
AP1	3.6	3.6	9.7	9.6	20.6	20.5
AP2	11.8	10.5	30.9	29.9	64.7	63.4
AP3	0.7	0.7	2.8	2.8	7.2	7.2
AP4	0.5	0.5	1.9	1.9	4.7	4.7

Impacts to watershed water quality from development within the watersheds are likely from uncontrolled discharge of site runoff during construction activities and stabilized developed surfaces. To minimize the impacts to the watersheds, stormwater treatment devices and erosion control methods have been sized in accordance with the Env-Wq 1500 and the *New Hampshire Stormwater Management Manual* (December, 2008).

2.6.2B Existing Site Conditions

The existing site consists of 61.64 acres of mostly wooded area, some areas of excavation (old gravel pits), with a large bog (wetland) at the southeast corner of the lot. This bog is also the low point of the site. The north and west sides of the site are heavily wooded, with the existing National Grid Transmission line easement running along the east property line adjacent Bog Road. The far north end of the site is not part of this project and will not be affected by the proposed development. Stormwater runoff moves from the northwest to the southeast to the wetland near Bog Road then under Bog Road and finally into Bog Brook. The project does not include water or wastewater systems.

2.6.3B Proposed Site Conditions & Disturbances

Approximately 232,218 square feet of earth disturbance will be required to construct the new interconnection station, substation, access road and stormwater treatment structures. The project does not propose any new paved surfaces as the new access road, substation and interconnection areas will be a mix of gravel areas or washed stone totaling 92,783 square feet. The project will include installing the following stormwater management features; micro extended detention pond; a surface filtration pond; and, at least one treatment swale. Note that there is no new work proposed at the northeast end of the project site, east of the existing utility line, therefore, there is no change in the pre-development to post-development site condition in this area and no stormwater modeling was done. An area of disturbance breakdown for the entire site is shown in **Table 2.1B**.

Table 2.1B – Proposed Disturbance Area Breakdown

Construction/Disturbance Activity	Area (square feet)	% EIC*	% UDC*
Total Impervious Cover (Buildings, Driveways, and Roadways)	92,783	3.46	
Slope Grading and Site Disturbance	139,435		
Total Disturbance	232,218		
Total Undisturbed Area (within Drainage Area)	2,452,820		91.35
Total Drainage Area (within Property)	2,685,038		

** EIC = Effective Impervious Cover*
** UDC = Undisturbed Cover*

The impacts to water quality during site development will be minimized using temporary treatment devices and erosion control measures. Frequent site inspections during construction are required during or directly following rainfall events to ensure erosion control devices are working properly. A copy of the Stormwater Inspection and Maintenance Manual can be found in **Section 3.8** of this report.

2.6.4B Rainfall Data

Using SCS TR-20, run under HydroCAD Version 9.1 with Type III-24 hour rainfall events, pre- and post-development cover types and drainage paths were modeled to generate peak discharge rates. Rainfall events modeled have intensities described by data provided by the Northeast Regional Climate Center for the geographic location of the project. This data is provided in full in section 2.13 of this report, and are summarized below in **Table 2.2B.**

Table 2.2B - Type III, 24 Hour Rainfall Depths for Project Site (43.581°N, 71.796°W)

Rainfall Event	Depth*
1-year	2.26”
2-Year	2.65”
10-Year	3.85”
50-Year	5.59”
100-Year	6.58”

** Rainfall depths from the Northeast Regional Climate Center Extreme Precipitation Tables, 24hr Storm “Extreme Precipitation Estimates”, http://precip.eas.cornell.edu, accessed 30 September 2013. See section 2.13*

2.6.5B Peak Runoff Control Requirement

The proposed stormwater treatment devices are designed to attenuate the larger, less frequent rainfall events as required by Env-Wq 1507.06. **Table 2.4B** summarizes the stormwater runoff peak flow rate for the 10 and 50 year storm events. For all discharge points peak flow rates either remain the same or decrease for the 10- and 50-year storm events.

Table 2.3B – 10 and 50 Year Comparison

Watershed Area Discharge Point	Pre 10 Yr Flow Rate (cfs)	Post 10 Yr Flow Rate (cfs)	Pre 50 Yr Flow Rate (cfs)	Post 50 Yr Flow Rate (cfs)
AP1	9.7	9.6	20.6	20.5
AP2	30.9	29.9	64.7	63.4
AP3	2.8	2.8	7.2	7.2
AP4	1.9	1.9	4.7	4.7

2.6.6B Channel Protection Requirement

NHDES requires that the receiving waters and downstream wetland channels be protected from erosion and sedimentation resulting from the project development. In order to show no impact to offsite channels, analysis of the proposed drainage system must meet one of the conditions in Env-Wq 1507.05. This project specifically meets Env-Wq 1507.05 (b) (1) (a). The analysis for the 2 year peak flow rate shows no increase in the post-development condition over the pre-development condition, as well as a reduction in stormwater volume discharged from the site. **Table 2.5B** shows that the stormwater runoff volume from discharge point AP1 decreased by 0.004 acre-feet, discharge from point AP2 increased by 0.025 acre-feet, discharge from point AP3 remains the same at 0.126 acre-feet and discharge from point AP4 remained the same at 0.070 acre-feet. This gives a net off-site increase of 0.021 acre-feet, more than meeting the allowed 0.10 acre-foot increase specified in Env-Wq 1507.05 (b) (1) (a). This can be attributed to the design intention that the impervious surfaces created by the project be directed thru storm water treatment structures. Additionally, attenuation measures designed for larger storms effectively capture all runoff before leaving the site for smaller storms.

Table 2.4B – Channel Protection Comparison Outlet Points

Outlet point	Pre 2 Yr Flow Rate (cfs)	Post 2 Yr Flow Rate (cfs)	Pre 2yr Vol. acre-feet (af)	Post 2yr Vol. acre-feet (af)
AP1	3.6	3.6	0.483	0.479
AP2	11.8	10.5	1.739	1.764
AP3	0.7	0.7	0.126	0.126
AP4	0.5	0.5	0.070	0.070
Total	16.6	15.3	2.418	2.439

2.6.7B Groundwater Recharge Volume

Under Env-Wq 1507.04, NHDES requires a portion of the stormwater runoff be infiltrated to protect groundwater resources by reducing the amount of water diverted off-site by the proposed development. As an example, surface filtration ponds are used as treatment on this site to infiltrate the runoff from impervious surfaces and the access drive. The groundwater recharge provided by the surface filtration pond is summarized in **Table 2.5B**.

Table 2.5B – Groundwater Recharge Volume Comparison

HSG	Required Groundwater Recharge Depth (in)	Net Proposed Effective Impervious Area (Acres)	GRV Required by NHDES (cubic feet)	GRV Provided (cubic feet)
A	0.40	0.050	711	2,922
B	0.25	0.560		
C	0.10	0.360		
D	0.00	1.0525		
Total		2.0225	711	2,922

2.6C Project Narrative
Operations and Maintenance Facility

2.6.1C Project Summary Operations and Maintenance Facility

The project will require the installation of an operations and maintenance facility, which is located in the town of Danbury, NH, on Lot 403 Tax Map 418, which is located at the end of Old Russel Road. The site work will include a new 5,460 square foot maintenance building and a 1,296 square foot snow cat storage building surrounded by a gravel surface approximately 200' wide by 450' long. The stormwater design will include a surface sand filtration pond. The calculated total disturbance for the work related to the operations and maintenance facility is based upon the work within its watershed area. The watershed area is equal to 596,217 square feet. The project disturbance associated with the operations and maintenance facility is equal to 197,998 square feet. The total proposed building area is 6,756 square feet. The total impervious gravel area is 91,413 square feet that is within the watershed area. This area includes 1,500 lf of proposed roads that link the operations and maintenance facility to the remaining portions of the wind farm. The following table shows the 2, 10 and 50 year peak flow rate comparison at the discharge points.

Table 2.0C – 2, 10 and 50 Year Comparison

Watershed Area Discharge Point	Pre 2 Yr Flow Rate (cfs)	Post 2 Yr Flow Rate (cfs)	Pre 10 Yr Flow Rate (cfs)	Post 10 Yr Flow Rate (cfs)	Pre 50 Yr Flow Rate (cfs)	Post 50 Yr Flow Rate (cfs)
AP1	5.5	3.5	13.1	8.5	26.2	24.6

Impacts to watershed water quality from development within the watersheds are likely from uncontrolled discharge of site runoff during construction activities and stabilized developed surfaces. To minimize the impacts to the watersheds, stormwater treatment devices and erosion control methods have been sized in accordance with the Env-Wq 1500 and the *New Hampshire Stormwater Management Manual* (December, 2008).

2.6.2C Existing Site Conditions

The property where this facility is proposed is approximately 48 acres. The drainage area associated with the facility is 13.7 acres. The majority of this area is currently grass fields with a portion of the area wooded to the west, towards Grants Pond. There is a gravel access running through the property used for farming and recreational purposes. A wetland along the east edge of the property intersects any runoff flowing down slope from the east. Remaining stormwater runoff moves from the east to the west running across the open fields and eventually to Grants Pond. The facility proposes to have a well drilled for water service and a subsurface effluent disposal system for the employees running the facility.

2.6.3C Proposed Site Conditions & Disturbances

Approximately 197,998 square feet of earth disturbance will be required to construct the new operations and maintenance facility, gravel parking, and stormwater treatment structures. The project will include the installation of a surface filtration pond to treat and infiltrate the stormwater runoff associated with the proposed facility. An area of disturbance breakdown within the project's watershed is shown in **Table 2.1C**.

Table 2.1C – Proposed Disturbance Area Breakdown

Construction/Disturbance Activity	Area (square feet)	% EIC*	% UDC*
Total Impervious Cover (Buildings, Parking, and Roadways)	98,169	16.5	
Slope Grading and Site Disturbance	99,829		
Total Disturbance	197,998		
Total Undisturbed Area (within the O&M Watershed)	398,219		66.8
Total Drainage Area (within the O&M Watershed)	596,217		

** EIC = Effective Impervious Cover*
** UDC = Undisturbed Cover*

The impacts to water quality during site development will be minimized using temporary treatment devices and erosion control measures. Frequent site inspections during construction are required during or directly following rainfall events to ensure erosion control devices are working properly. A copy of the Stormwater Inspection and Maintenance Manual can be found in **Section 3.8** of this report.

2.6.4C Rainfall Data

Using SCS TR-20, run under HydroCAD Version 9.1 with Type III-24 hour rainfall events, pre- and post-development cover types and drainage paths were modeled to generate peak discharge rates. Rainfall events modeled have intensities described by data provided by the Northeast Regional Climate Center for the geographic location of the project. These data is provided in full in section 2.13 of this report, and are summarized below in **Table 2.2C**.

Table 2.2C - Type III, 24 Hour Rainfall Depths for Project Site (43.581°N, 71.796°W)

Rainfall Event	Depth*
1-year	2.26”
2-Year	2.65”
10-Year	3.85”
50-Year	5.59”
100-Year	6.58”

** Rainfall depths from the Northeast Regional Climate Center Extreme Precipitation Tables, 24hr Storm “Extreme Precipitation Estimates”, http://precip.eas.cornell.edu, accessed 30 September 2013. See section 2.13*

2.6.5C Peak Runoff Control Requirement

The proposed stormwater treatment devices are designed to attenuate the larger, less frequent rainfall events as required by Env-Wq 1507.06. **Table 2.3C** summarizes the stormwater runoff peak flow rate for the 10 and 50 year storm events. For all discharge points peak flow rates either remain the same or decrease for the 10- and 50-year storm events.

Table 2.3C – 10 and 50 Year Comparison

Watershed Area Discharge Point	Pre 10 Yr Flow Rate (cfs)	Post 10 Yr Flow Rate (cfs)	Pre 50 Yr Flow Rate (cfs)	Post 50 Yr Flow Rate (cfs)
AP1	13.1	8.5	26.2	24.6

2.6.6C Channel Protection Requirement

NHDES requires that the receiving waters and downstream wetland channels be protected from erosion and sedimentation resulting from the project development. In order to show no impact to offsite channels, analysis of the proposed drainage system must meet one of the conditions in Env-Wq 1507.05. This project specifically meets Env-Wq 1507.05 (b) (1) (a). The analysis for the 2 year peak flow rate shows no increase in the post-development condition over the pre-development condition, as well as a reduction in stormwater volume discharged from the site. **Table 2.4C** shows that the stormwater runoff flow rate and volume from discharge point AP1 decreased. This can be attributed to the design intention that the impervious surfaces created by the project be directed thru storm water treatment structures. Additionally, attenuation measures designed for larger storms effectively capture all runoff before leaving the site for smaller storms.

Table 2.4C – Channel Protection Comparison Outlet Points

Outlet point	Pre 2 Yr Flow Rate (cfs)	Post 2 Yr Flow Rate (cfs)	Pre 2yr Vol. acre-feet (af)	Post 2yr Vol. acre-feet (af)
AP1	5.5	3.5	0.843	0.536

2.6.7C Groundwater Recharge Volume

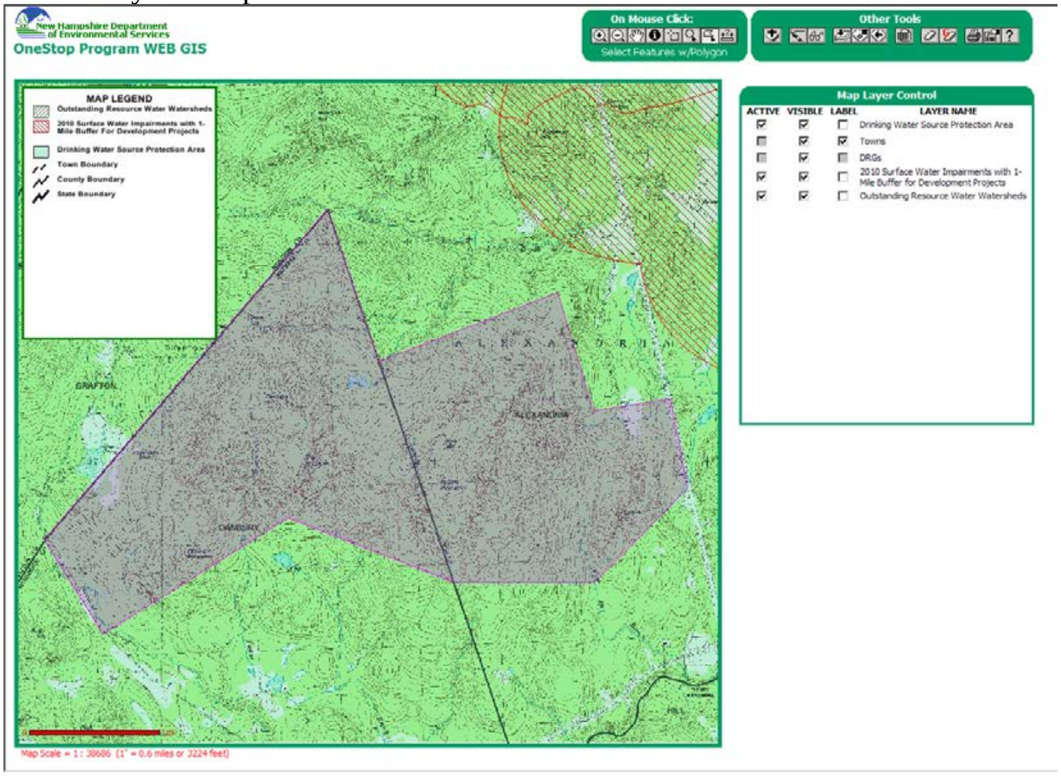
Under Env-Wq 1507.04, NHDES requires a portion of the stormwater runoff be infiltrated to protect groundwater resources by reducing the amount of water diverted off-site by the proposed facility. As an example, surface filtration ponds are used as treatment on this site to infiltrate the runoff from impervious surfaces and the access drive. The groundwater recharge provided by the surface filtration pond is summarized in **Table 2.5C**.

Table 2.5C – Groundwater Recharge Volume Comparison

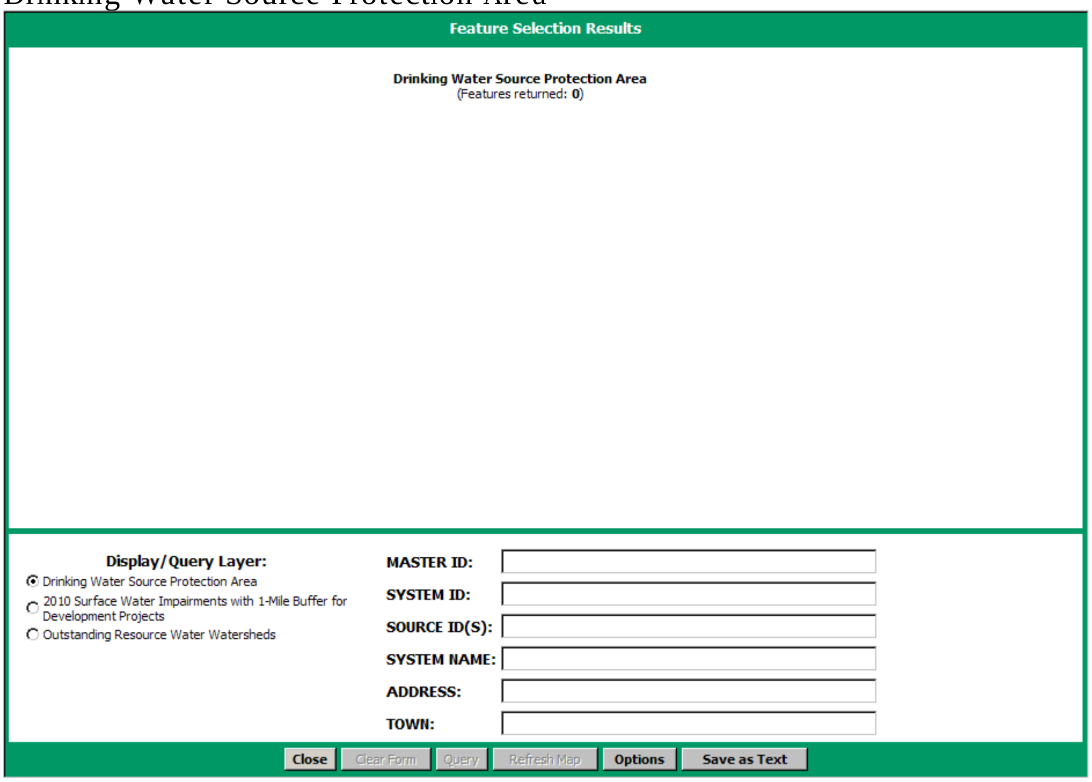
HSG	Required Groundwater Recharge Depth (in)	Net Proposed Effective Impervious Area (Acres)	GRV Required by NHDES (cubic feet)	GRV Provided (cubic feet)
A	0.40	0	818	8,542
B	0.25	0		
C	0.10	2.25		
D	0.00	0		
	Total	2.25	818	8,542

2.7 Surface Water Impairments

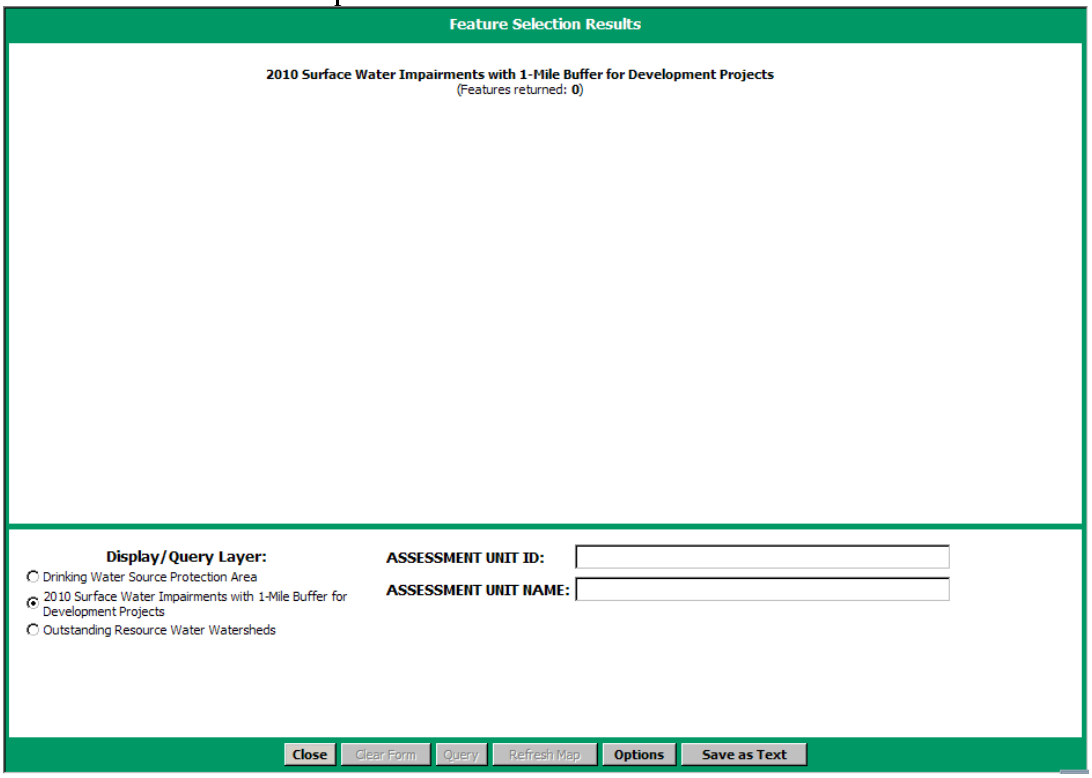
Water Layers Map OVERALL PROJECT



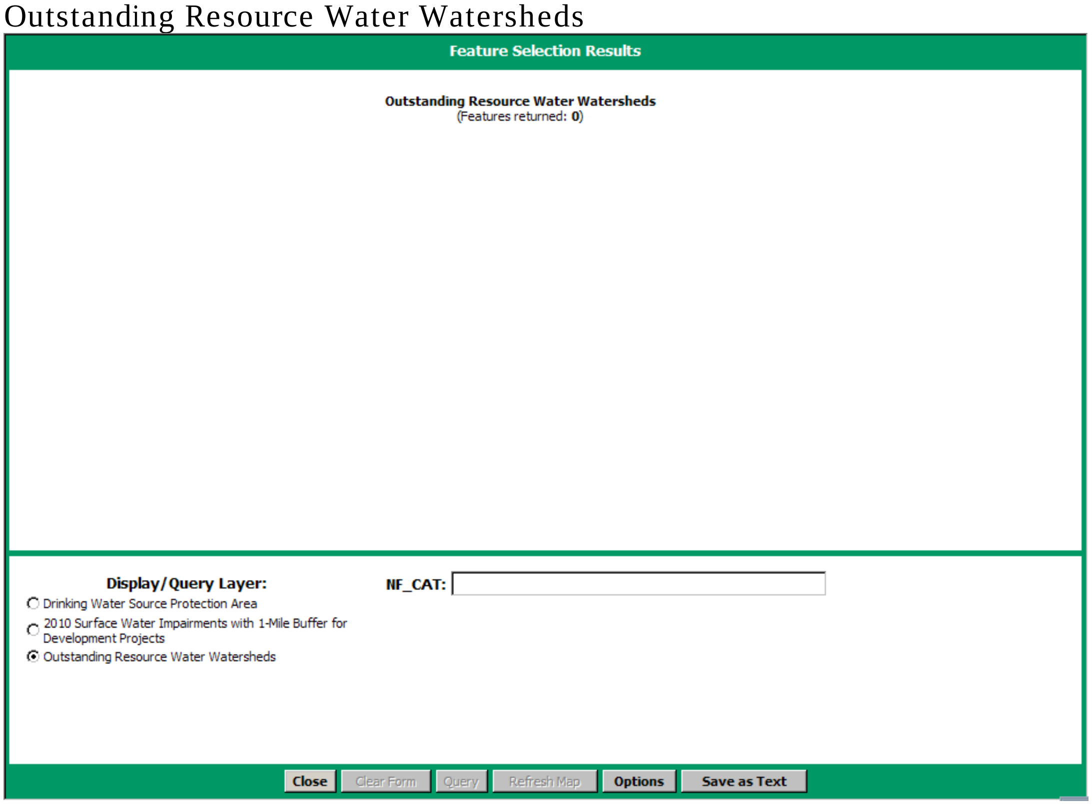
Drinking Water Source Protection Area



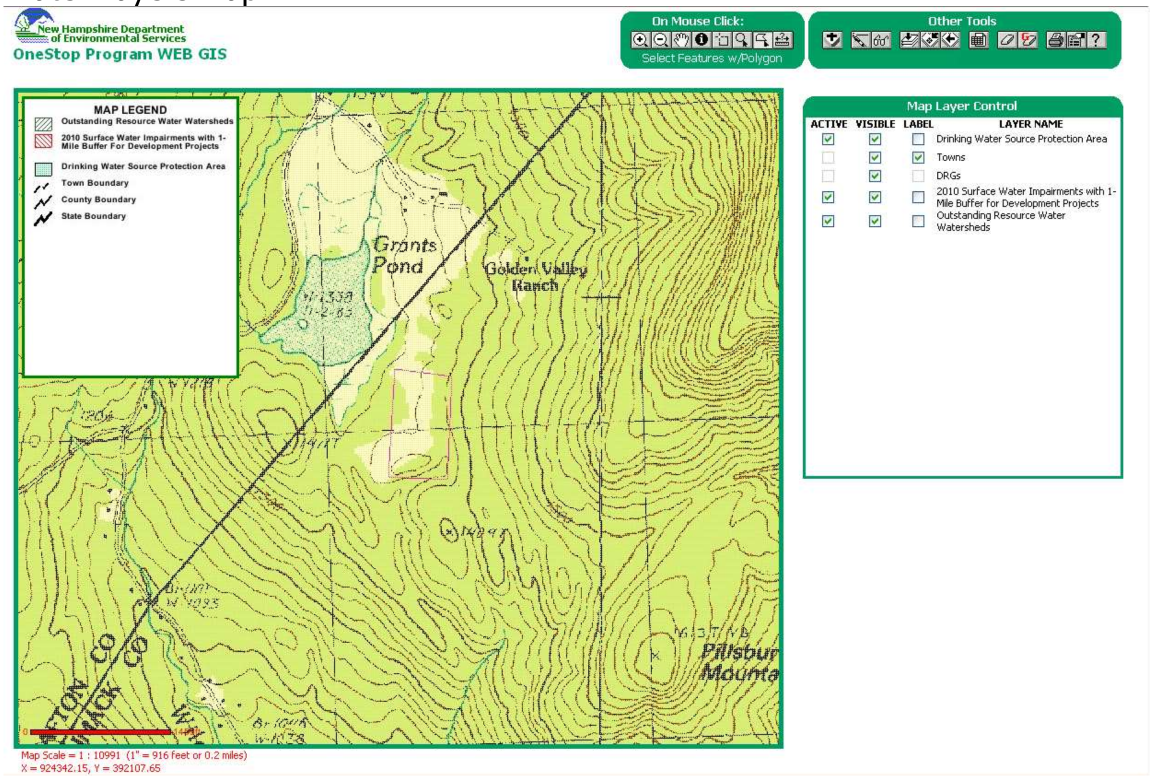
2010 Surface Water Impairments



Outstanding Resource Water Watersheds



Water Layers Map O & M BUILDING



Drinking Water Source Protection Area

Feature Selection Results

Drinking Water Source Protection Area
Features returned: 1 of 49.

MASTER ID	SYSTEM ID	SOURCE ID(S)	SYSTEM NAME	ADDRESS	TOWN
18579	1621010	4	PENNICHUCK WATER WORKS	200 CONCORD ST	NASHUA

Display/Query Layer:

- Drinking Water Source Protection Area
- 2010 Surface Water Impairments with 1-Mile Buffer for Development Projects
- Outstanding Resource Water Watersheds

MASTER ID:

SYSTEM ID:

SOURCE ID(S):

SYSTEM NAME:

ADDRESS:

TOWN:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

2010 Surface Water Impairments

Feature Selection Results

2010 Surface Water Impairments with 1-Mile Buffer for Development Projects
(Features returned: **0**)

Display/Query Layer:

- ○ Drinking Water Source Protection Area
- ◉ 2010 Surface Water Impairments with 1-Mile Buffer for Development Projects
- ○ Outstanding Resource Water Watersheds

ASSESSMENT UNIT ID:

ASSESSMENT UNIT NAME:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

Outstanding Resource Water Watersheds

Feature Selection Results

Outstanding Resource Water Watersheds
(Features returned: **0**)

Display/Query Layer:

- ○ Drinking Water Source Protection Area
- ○ 2010 Surface Water Impairments with 1-Mile Buffer for Development Projects
- ◉ Outstanding Resource Water Watersheds

NF_CAT:

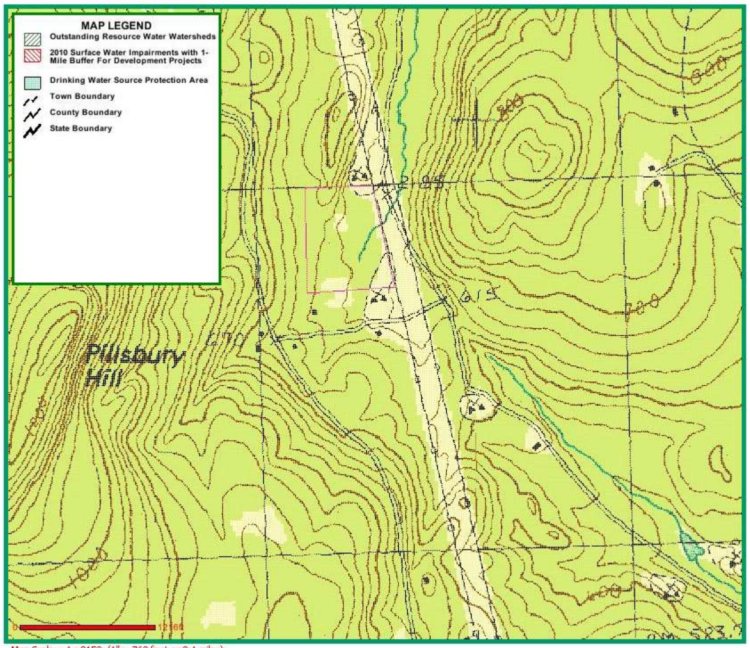
Close | Clear Form | Query | Refresh Map | Options | Save as Text

Water Layers Map SUBSTATION

New Hampshire Department of Environmental Services
OneStop Program WEB GIS

On Mouse Click:
Select Features w/Polygon

Other Tools



Map Scale = 1 : 9159 (1" = 763 feet or 0.1 miles)
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Map Layer Control

ACTIVE	VISIBLE	LABEL	LAYER NAME
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☐	☑	☑	Towns
☐	☑	☐	DRGs
☑	☑	☐	2010 Surface Water Impairments with 1-Mile Buffer for Development Projects
☑	☑	☐	Outstanding Resource Water Watersheds

Drinking Water Source Protection Area

Feature Selection Results

Drinking Water Source Protection Area
Features returned: 1 of 49.

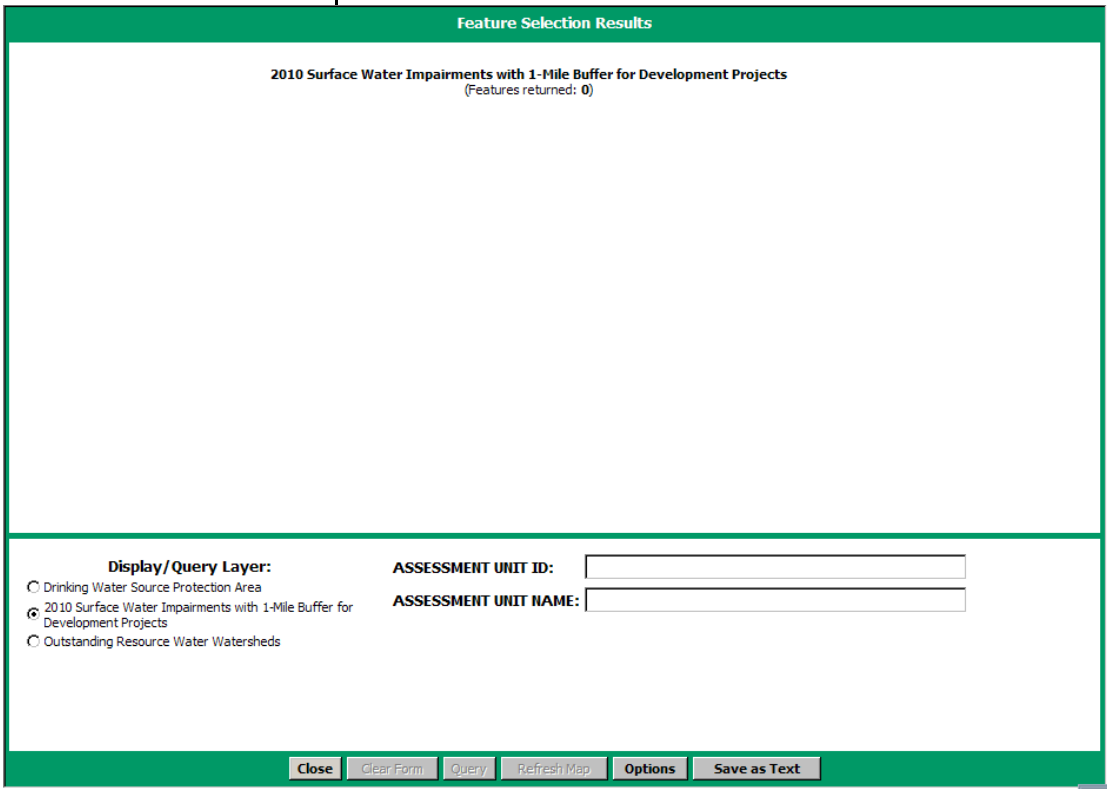
MASTER ID	SYSTEM ID	SOURCE ID(S)	SYSTEM NAME	ADDRESS	TOWN
18579	1621010	4	PENNICHUCK WATER WORKS	200 CONCORD ST	NASHUA

Display/Query Layer:
- ◉ Drinking Water Source Protection Area
- ○ 2010 Surface Water Impairments with 1-Mile Buffer for Development Projects
- ○ Outstanding Resource Water Watersheds

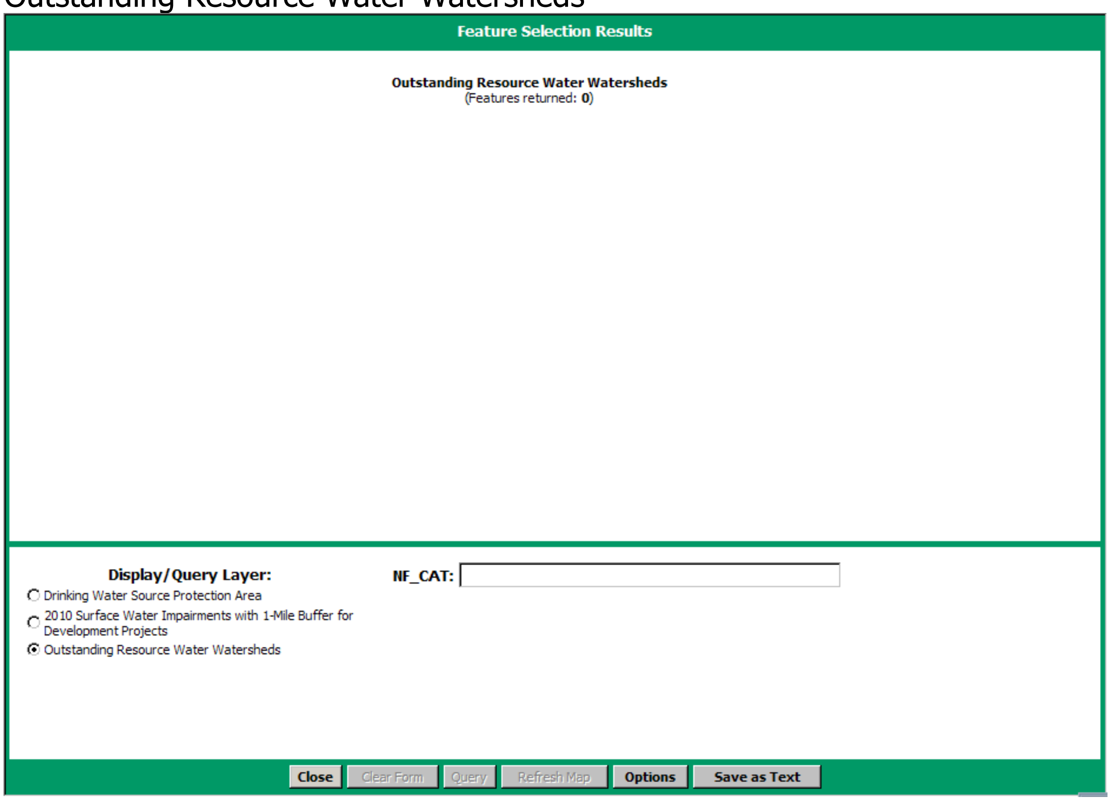
MASTER ID:
SYSTEM ID:
SOURCE ID(S):
SYSTEM NAME:
ADDRESS:
TOWN:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

2010 Surface Water Impairments

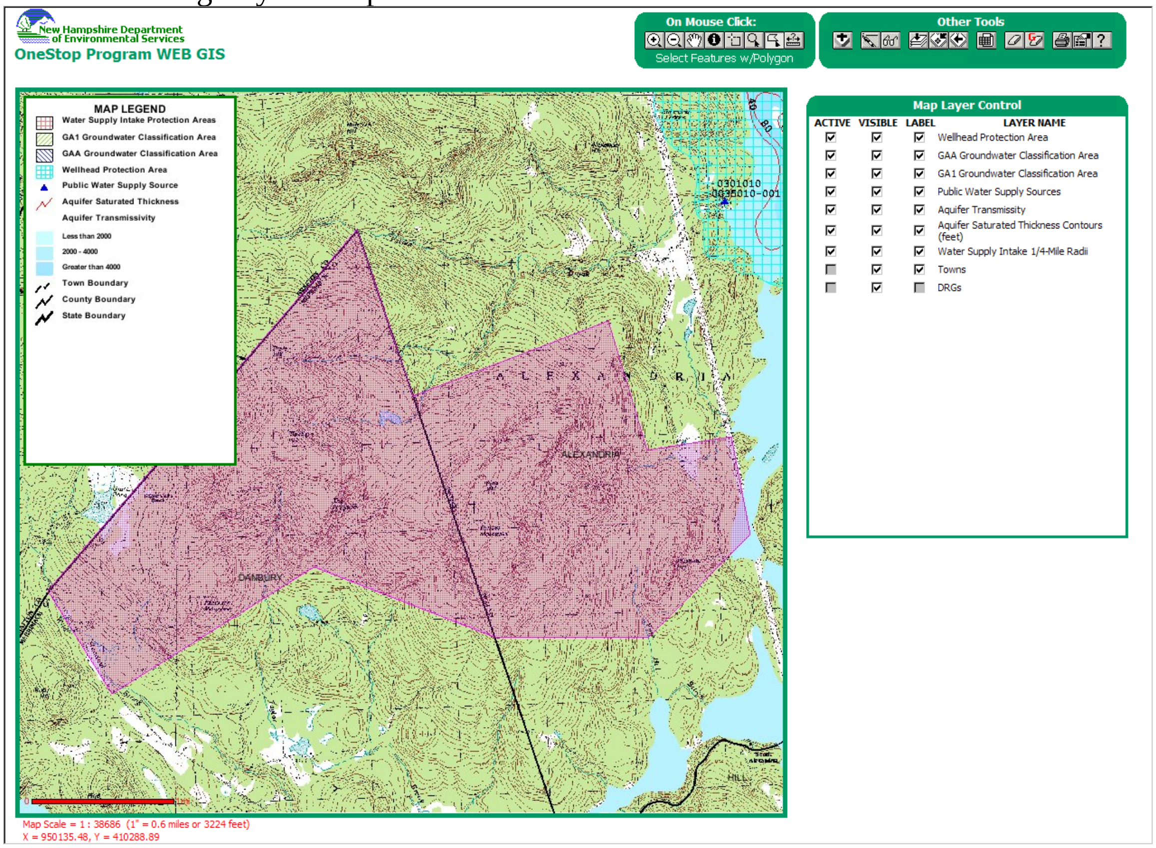


Outstanding Resource Water Watersheds

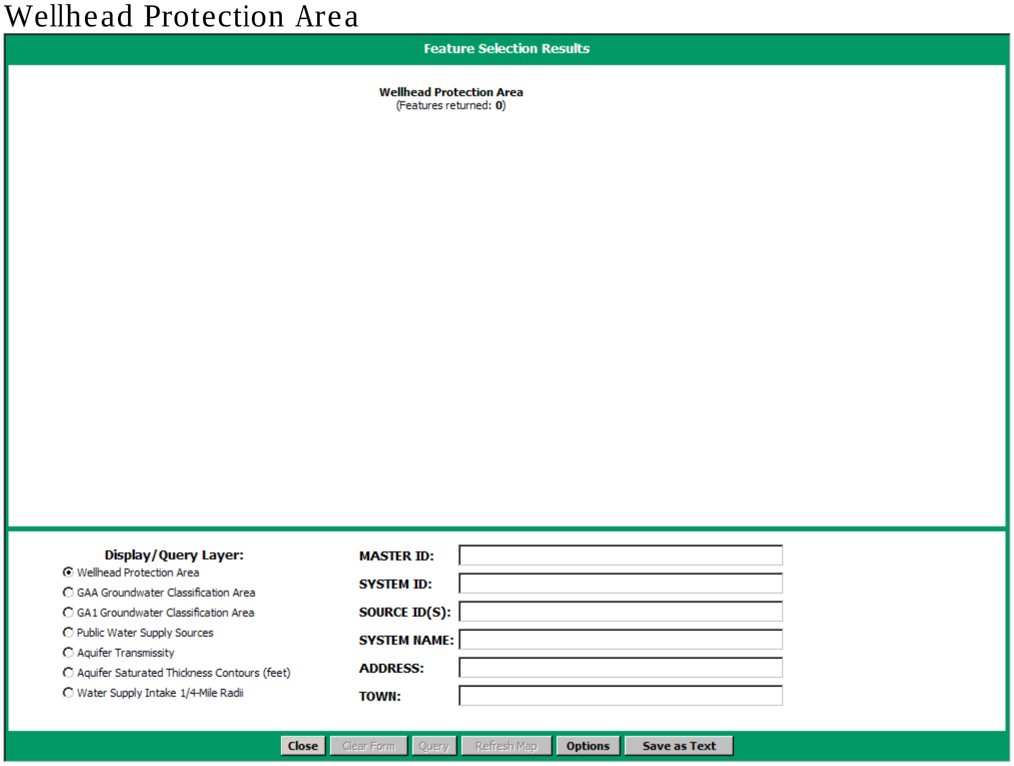


2.8 AOT Screening Layers

AOT Screening Layers Map OVERALL PROJECT



Wellhead Protection Area



Feature Selection Results

Wellhead Protection Area
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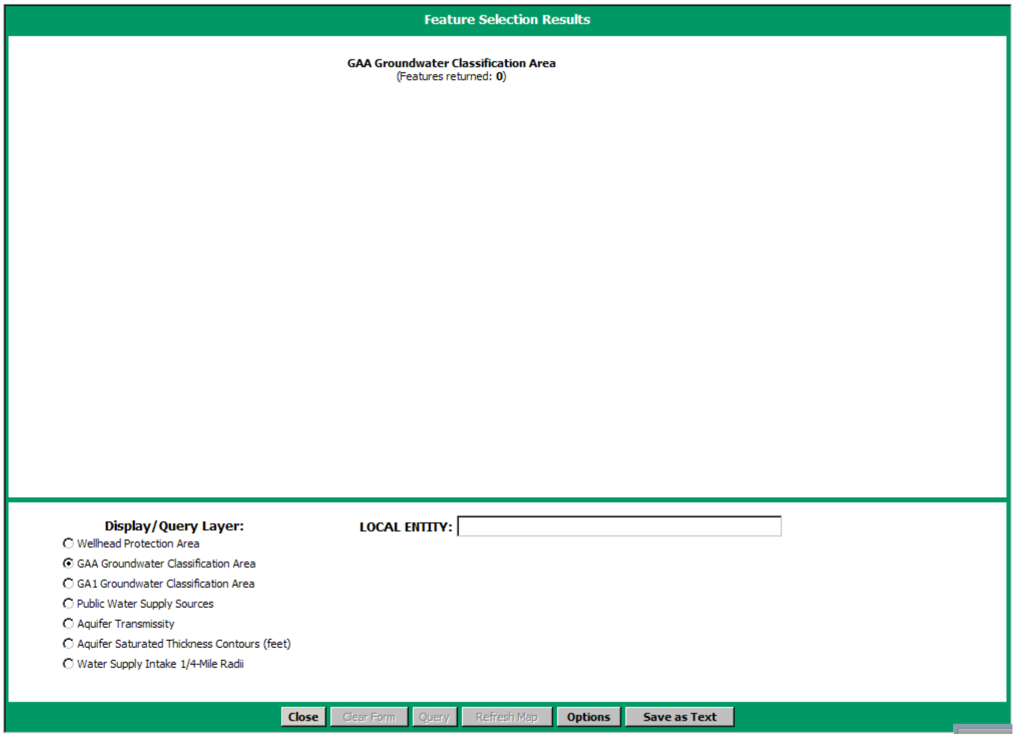
Display/Query Layer:

- Wellhead Protection Area
- GAA Groundwater Classification Area
- GA1 Groundwater Classification Area
- Public Water Supply Sources
- Aquifer Transmissivity
- Aquifer Saturated Thickness Contours (feet)
- Water Supply Intake 1/4-Mile Radii

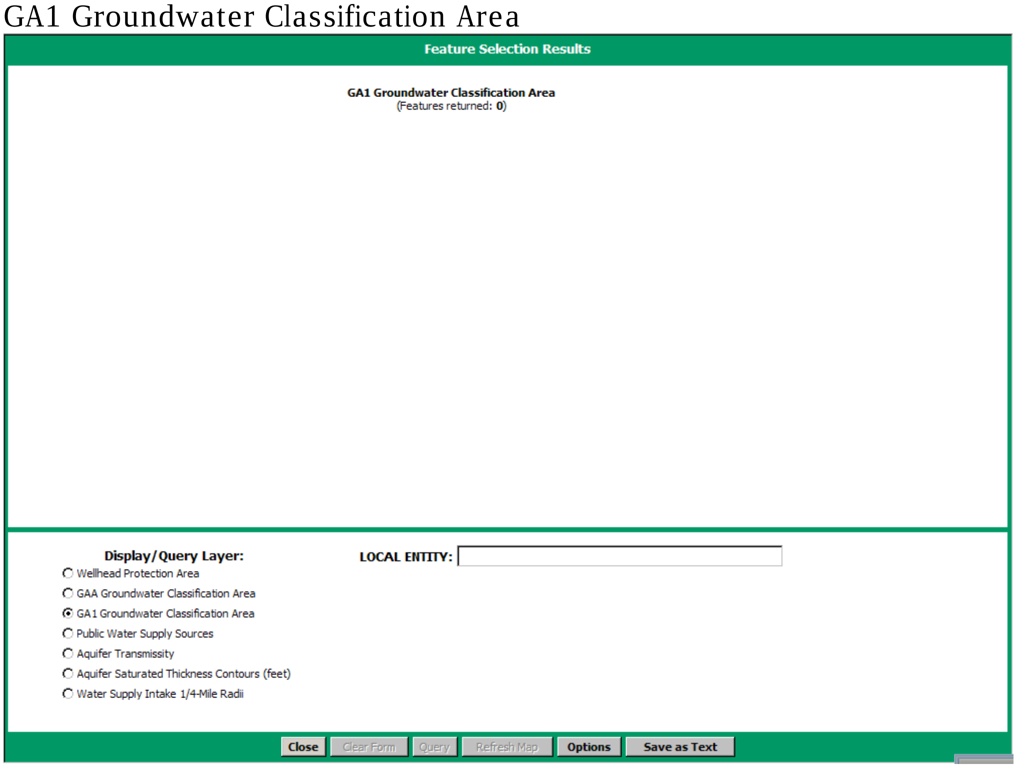
MASTER ID:
SYSTEM ID:
SOURCE ID(S):
SYSTEM NAME:
ADDRESS:
TOWN:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

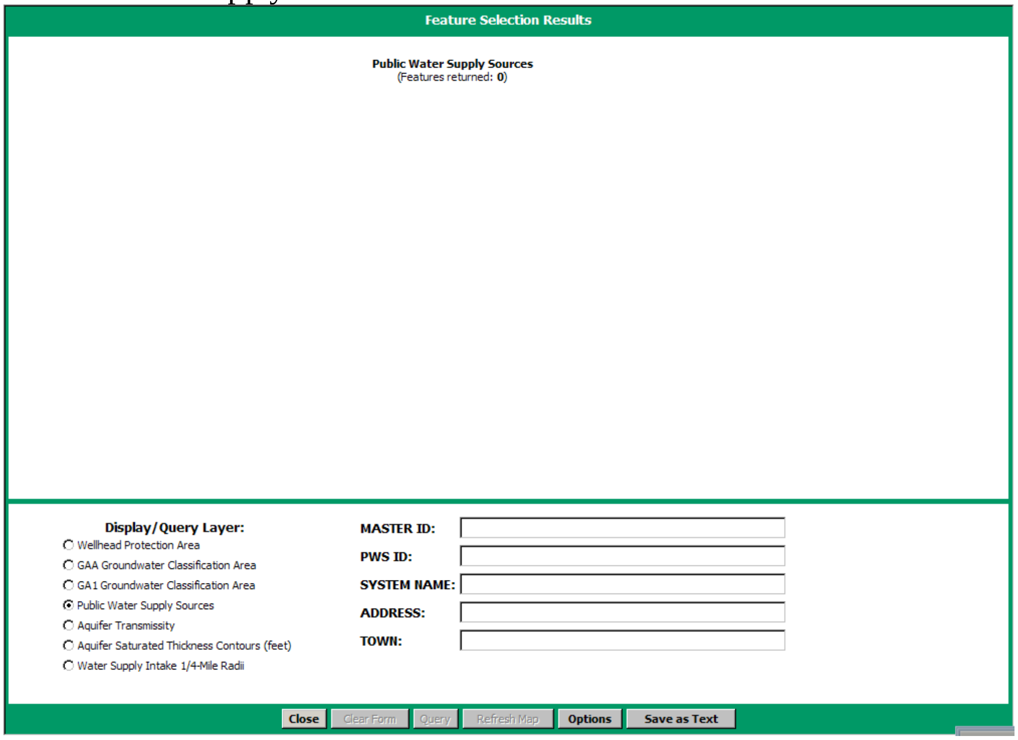
GAA Groundwater Classification Area



GA1 Groundwater Classification Area



Public Water Supply Sources



Feature Selection Results

Public Water Supply Sources
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Display/Query Layer:

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- ○ GAA Groundwater Classification Area
- ○ GA1 Groundwater Classification Area
- ◉ Public Water Supply Sources
- ○ Aquifer Transmissity
- ○ Aquifer Saturated Thickness Contours (feet)
- ○ Water Supply Intake 1/4-Mile Radii

MASTER ID:
PWS ID:
SYSTEM NAME:
ADDRESS:
TOWN:

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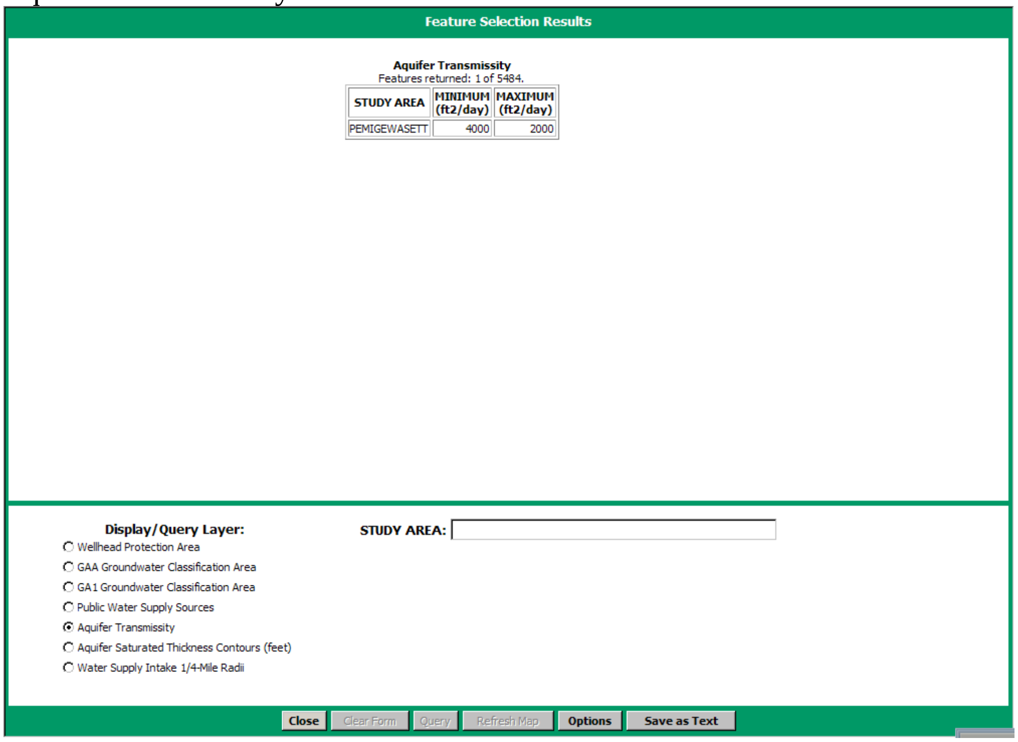
Aquifer Transmissity



Feature Selection Results

Aquifer Transmissity
Features returned: 1 of 5484.

STUDY AREA	MINIMUM (ft2/day)	MAXIMUM (ft2/day)
PEMIGEWASETT	4000	2000

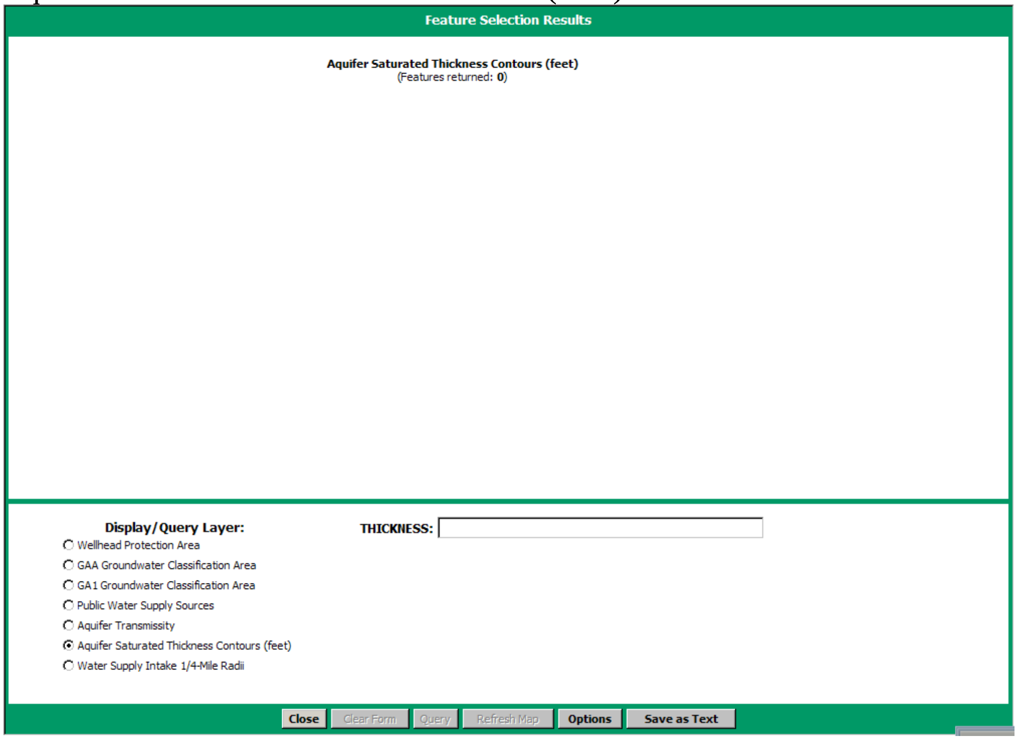
Display/Query Layer:

- ○ Wellhead Protection Area
- ○ GAA Groundwater Classification Area
- ○ GA1 Groundwater Classification Area
- ○ Public Water Supply Sources
- ◉ Aquifer Transmissity
- ○ Aquifer Saturated Thickness Contours (feet)
- ○ Water Supply Intake 1/4-Mile Radii

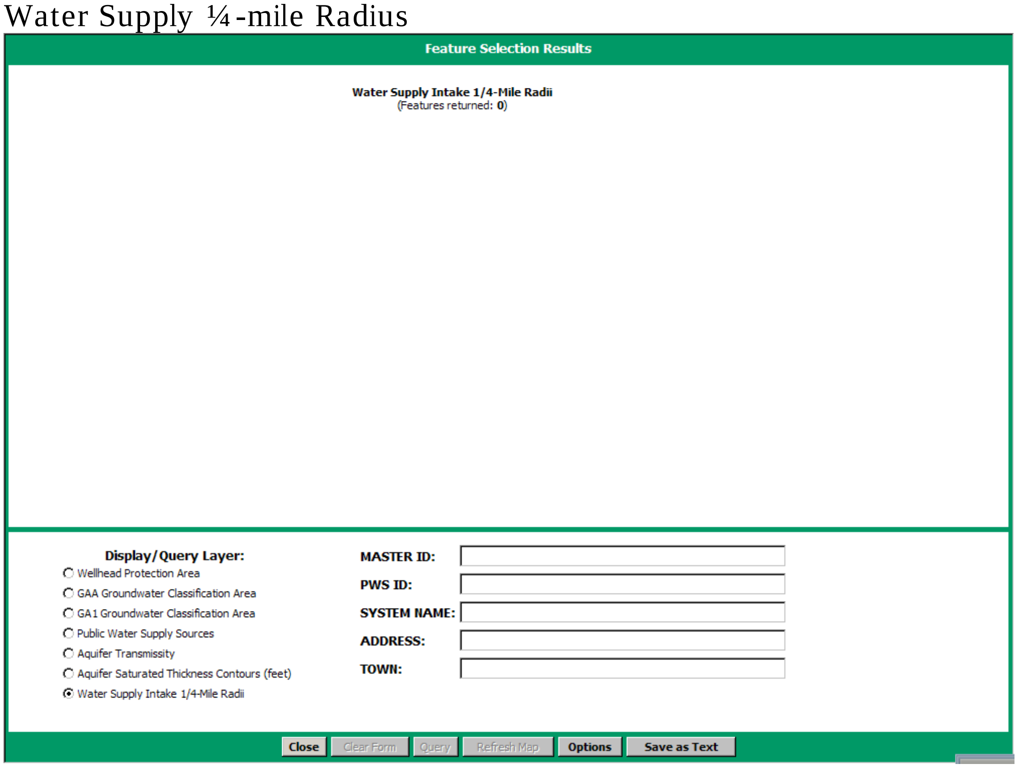
STUDY AREA:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

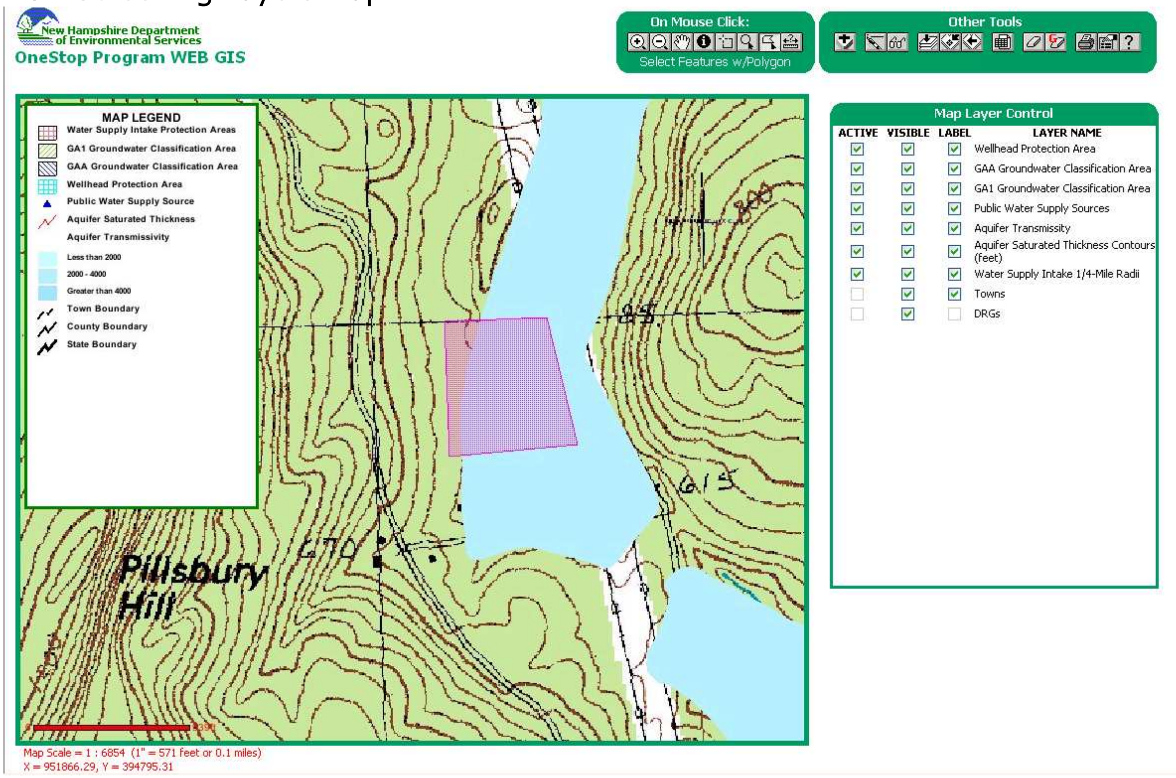
Aquifer Saturated Thickness Contours (feet)



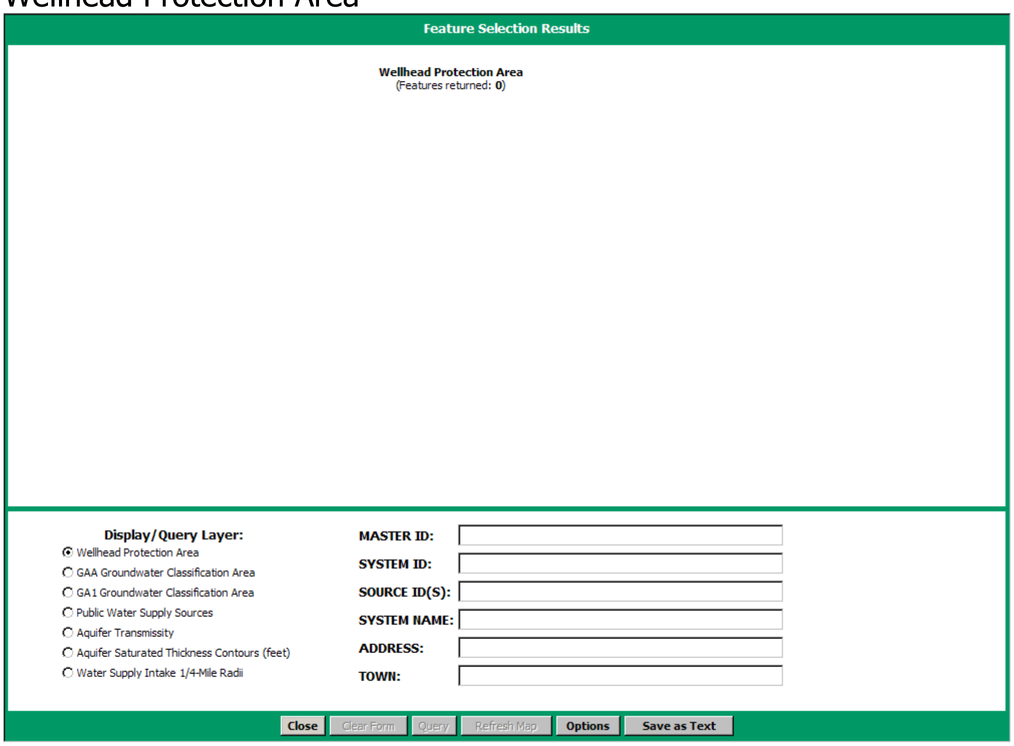
Water Supply ¼-mile Radius



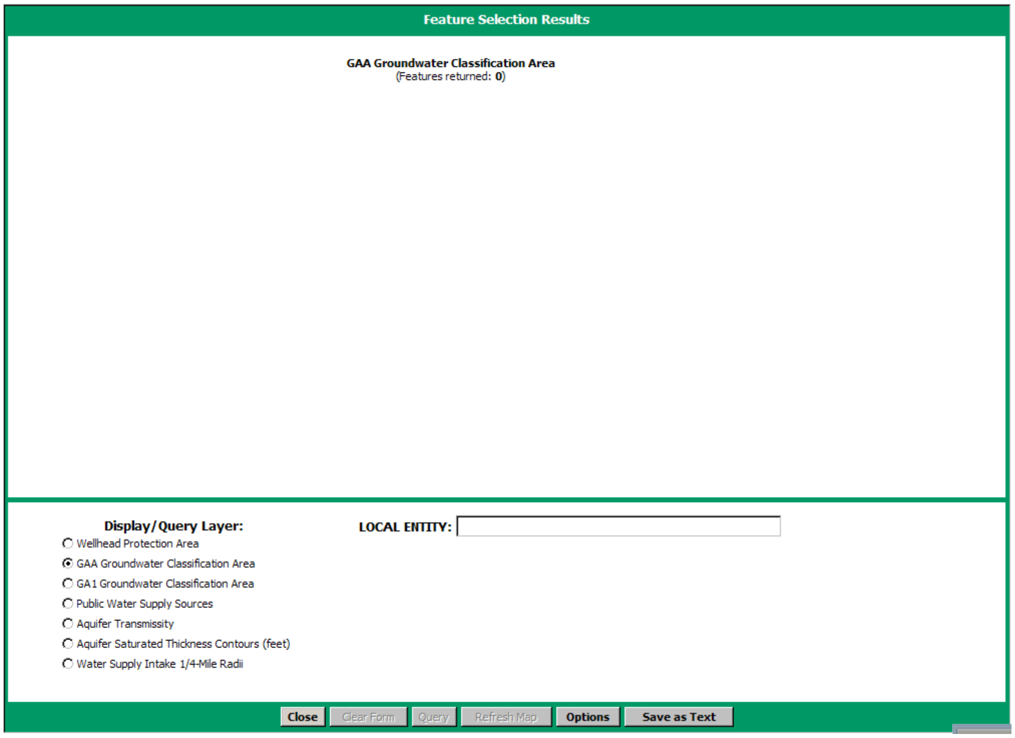
AOT Screening Layers Map SUBSTATION



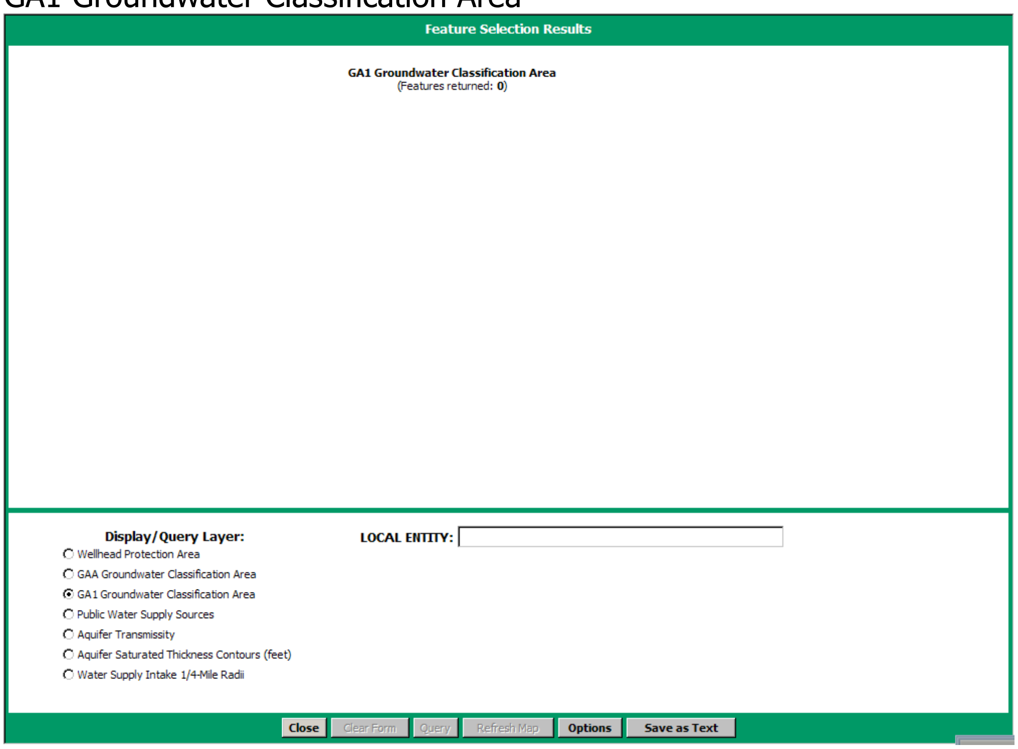
Wellhead Protection Area



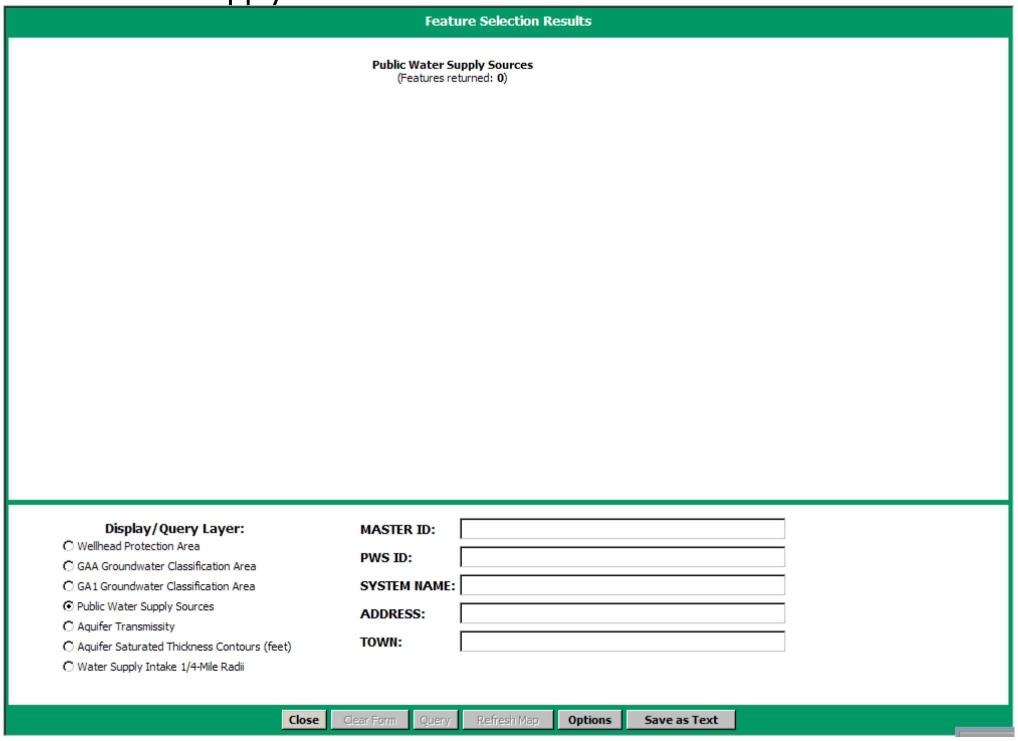
GAA Groundwater Classification Area



GA1 Groundwater Classification Area



Public Water Supply Sources



Feature Selection Results

Public Water Supply Sources
(Features returned: **0**)

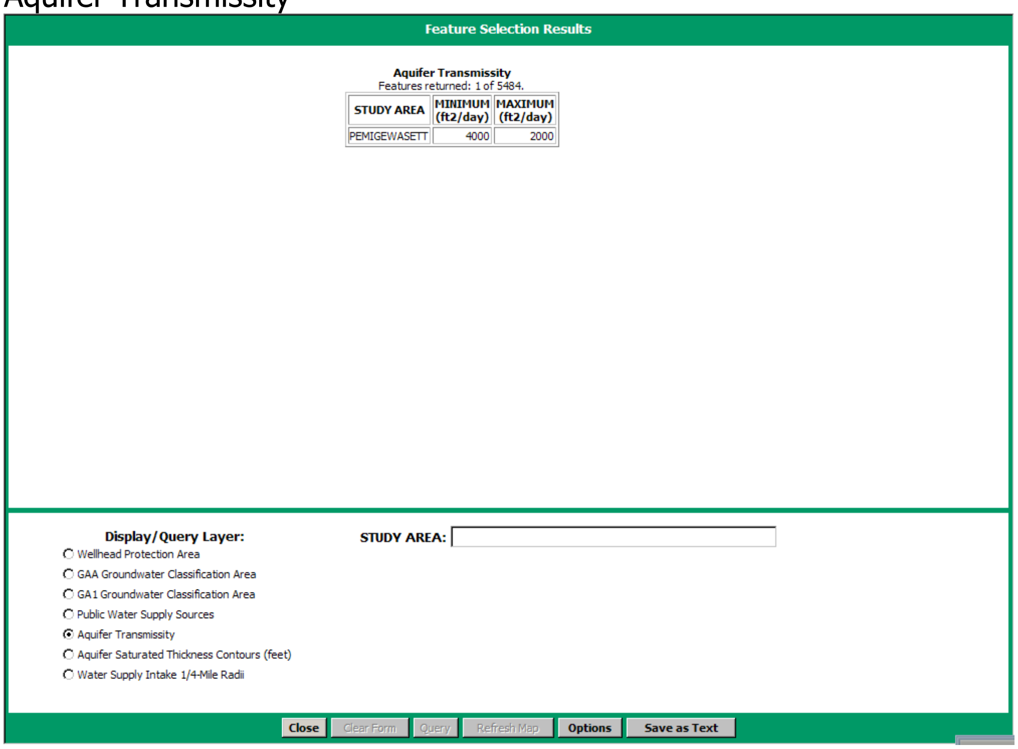
Display/Query Layer:

- Wellhead Protection Area
- GAA Groundwater Classification Area
- GA1 Groundwater Classification Area
- (selected) Public Water Supply Sources
- Aquifer Transmissity
- Aquifer Saturated Thickness Contours (feet)
- Water Supply Intake 1/4-Mile Radii

MASTER ID:
PWS ID:
SYSTEM NAME:
ADDRESS:
TOWN:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

Aquifer Transmissity



Feature Selection Results

Aquifer Transmissity
Features returned: 1 of 5484.

STUDY AREA	MINIMUM (ft2/day)	MAXIMUM (ft2/day)
PEMIGEWASETT	4000	2000

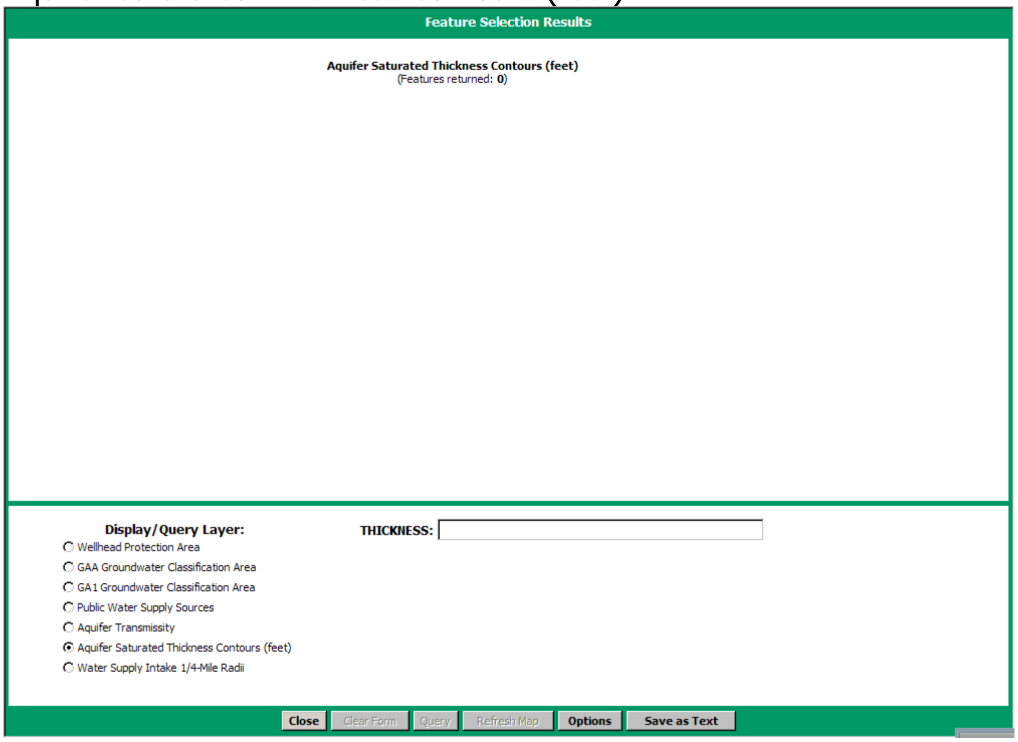
Display/Query Layer:

- Wellhead Protection Area
- GAA Groundwater Classification Area
- GA1 Groundwater Classification Area
- Public Water Supply Sources
- (selected) Aquifer Transmissity
- Aquifer Saturated Thickness Contours (feet)
- Water Supply Intake 1/4-Mile Radii

STUDY AREA:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

Aquifer Saturated Thickness Contours (feet)


Feature Selection Results

Aquifer Saturated Thickness Contours (feet)
(Features returned: **0**)

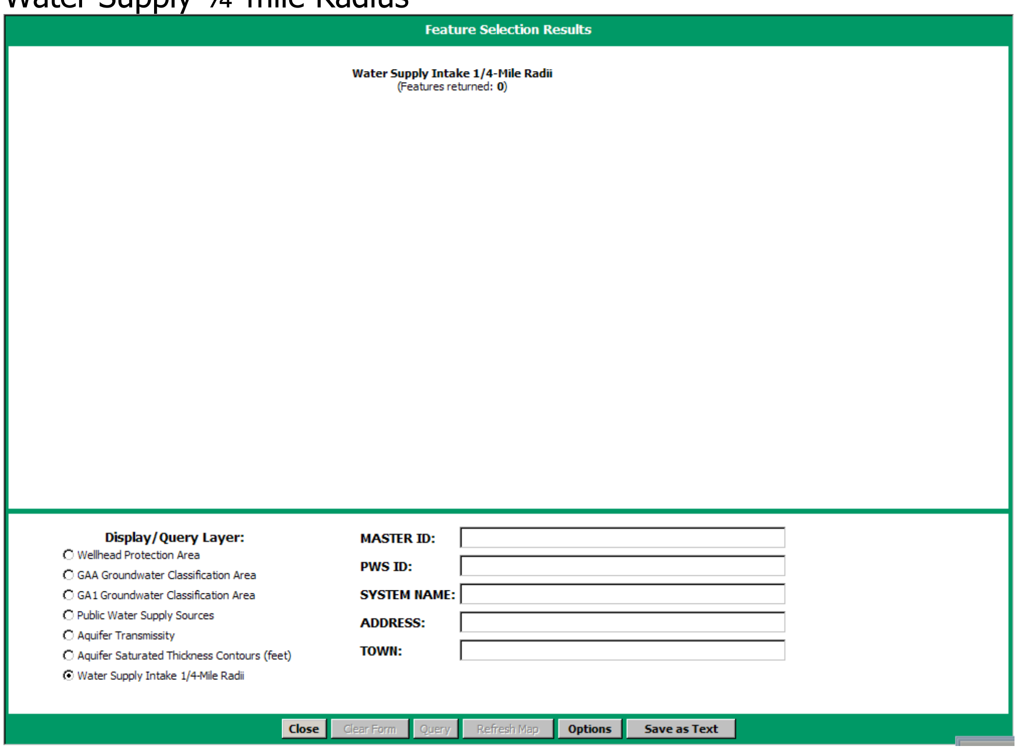
Display/Query Layer:

- ○ Wellhead Protection Area
- ○ GAA Groundwater Classification Area
- ○ GA1 Groundwater Classification Area
- ○ Public Water Supply Sources
- ○ Aquifer Transmissity
- ◉ Aquifer Saturated Thickness Contours (feet)
- ○ Water Supply Intake 1/4-Mile Radii

THICKNESS:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

Water Supply ¼-mile Radius


Feature Selection Results

Water Supply Intake 1/4-Mile Radii
(Features returned: **0**)

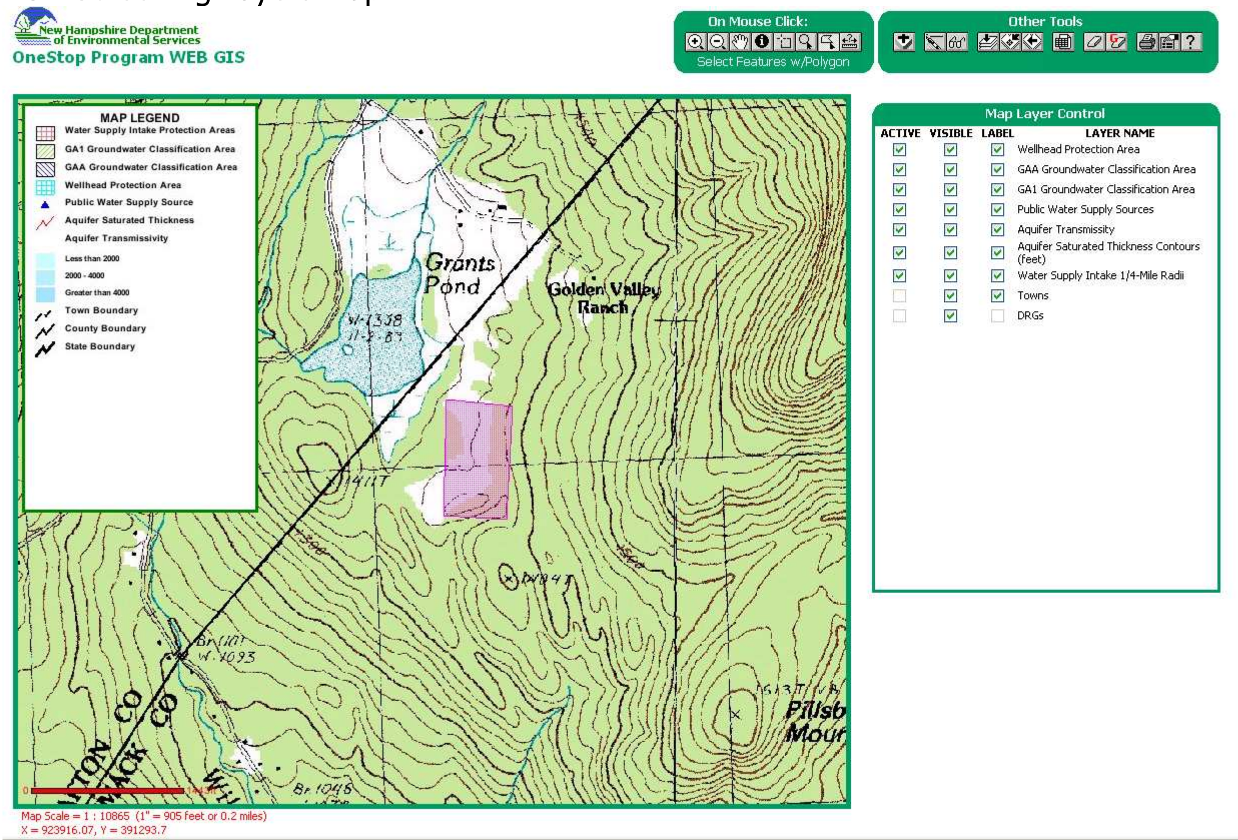
Display/Query Layer:

- ○ Wellhead Protection Area
- ○ GAA Groundwater Classification Area
- ○ GA1 Groundwater Classification Area
- ○ Public Water Supply Sources
- ○ Aquifer Transmissity
- ○ Aquifer Saturated Thickness Contours (feet)
- ◉ Water Supply Intake 1/4-Mile Radii

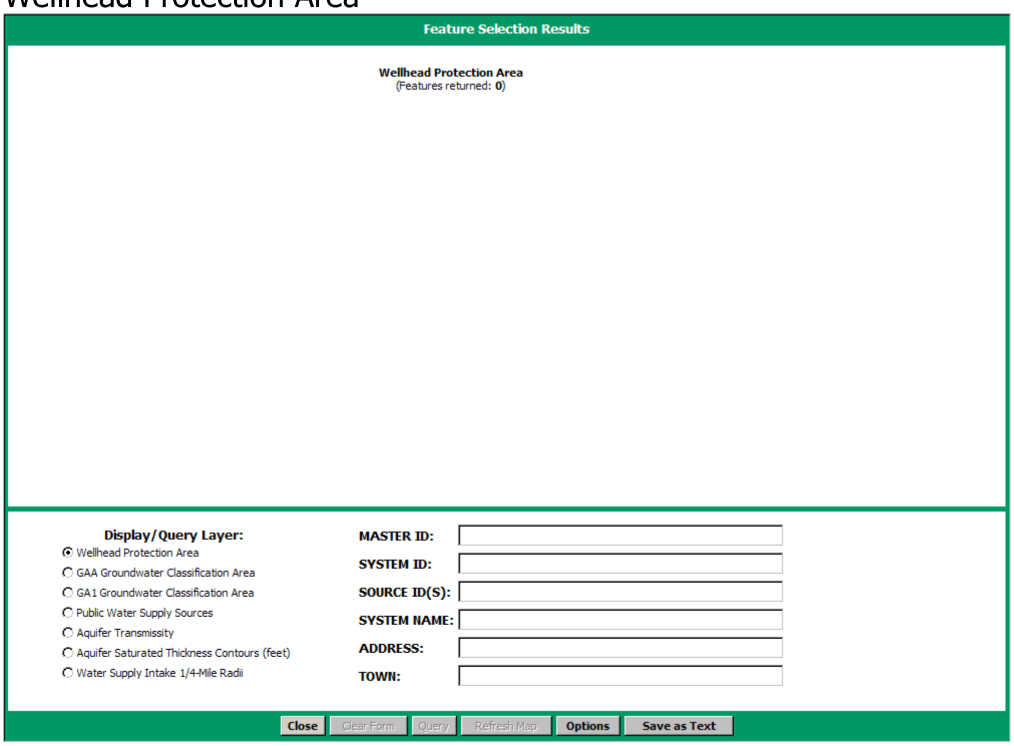
MASTER ID:
PWS ID:
SYSTEM NAME:
ADDRESS:
TOWN:

Close | Clear Form | Query | Refresh Map | Options | Save as Text

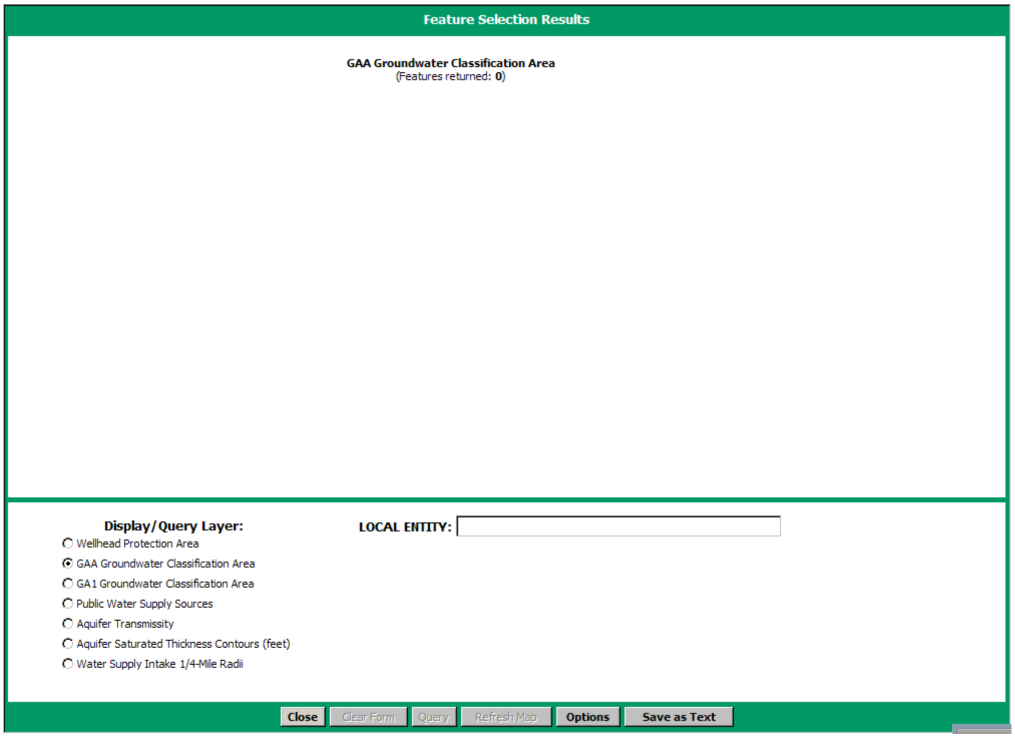
AOT Screening Layers Map O & M BUILDING



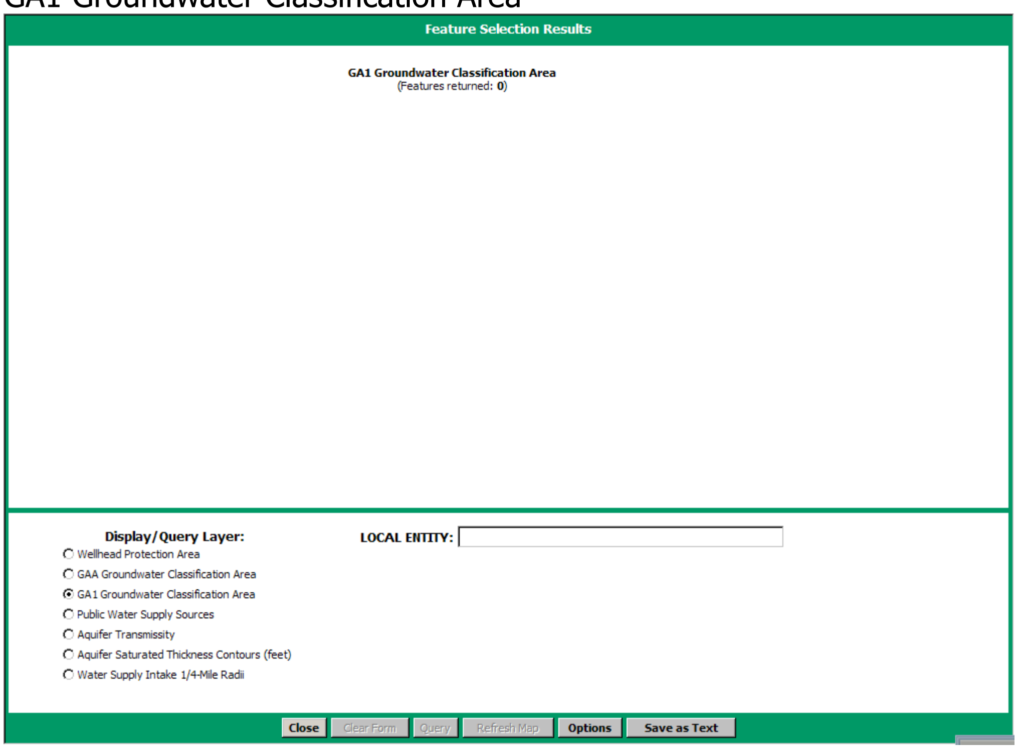
Wellhead Protection Area



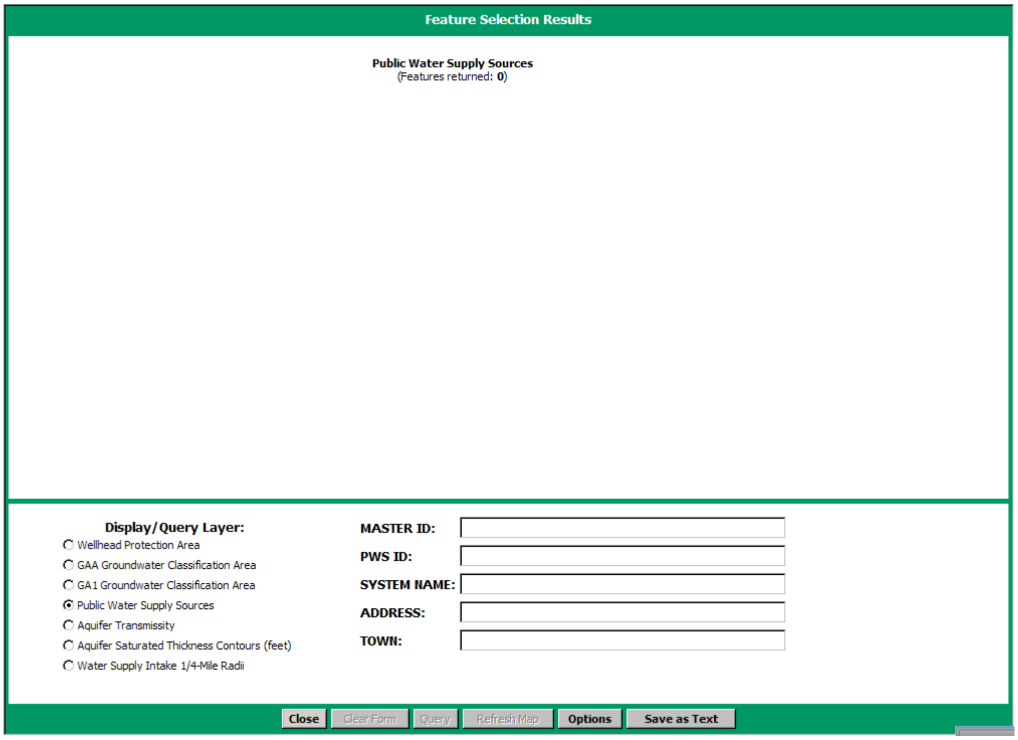
GAA Groundwater Classification Area



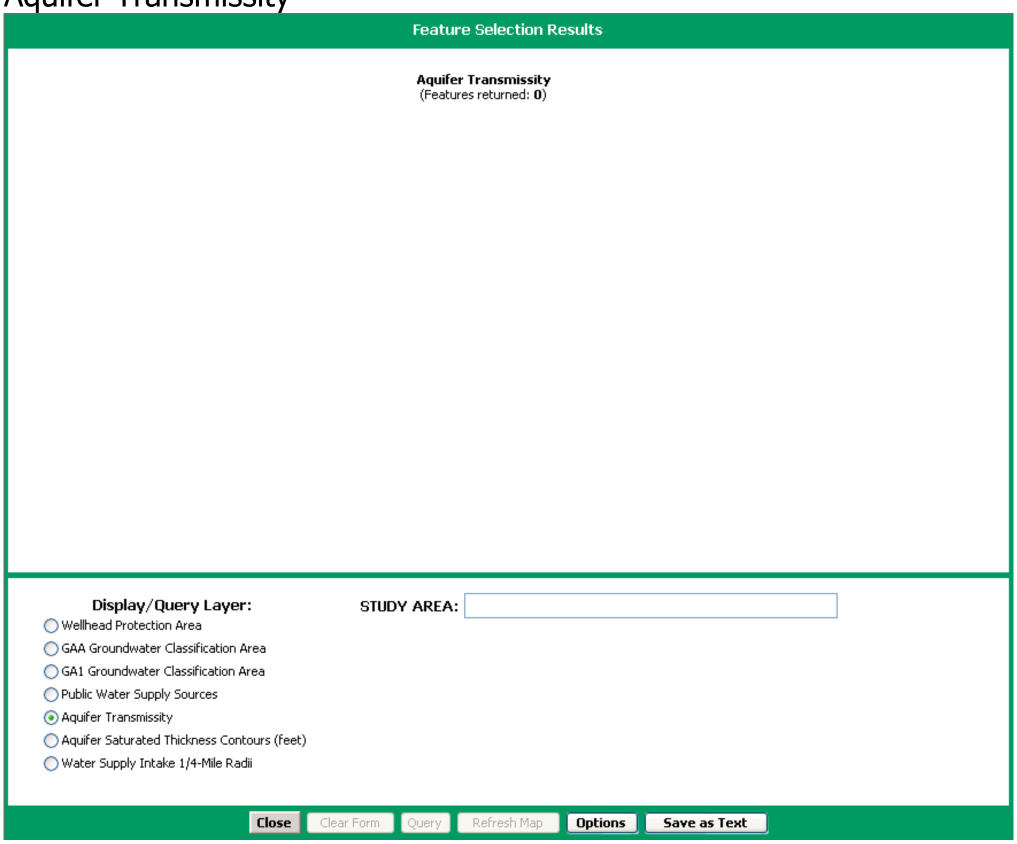
GA1 Groundwater Classification Area



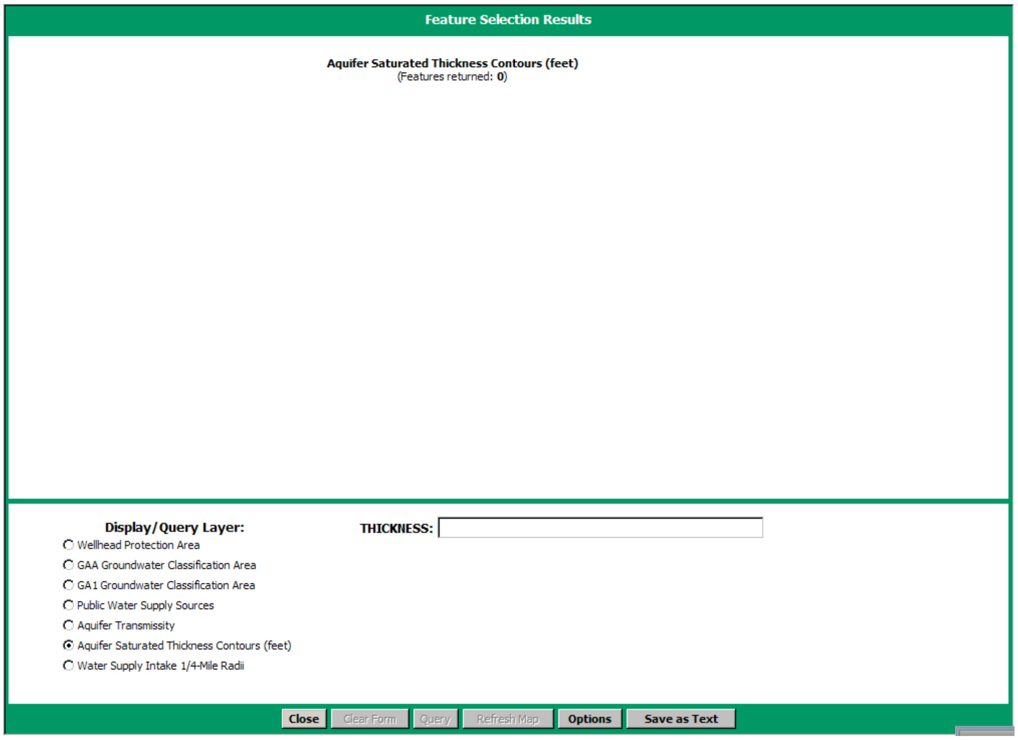
Public Water Supply Sources



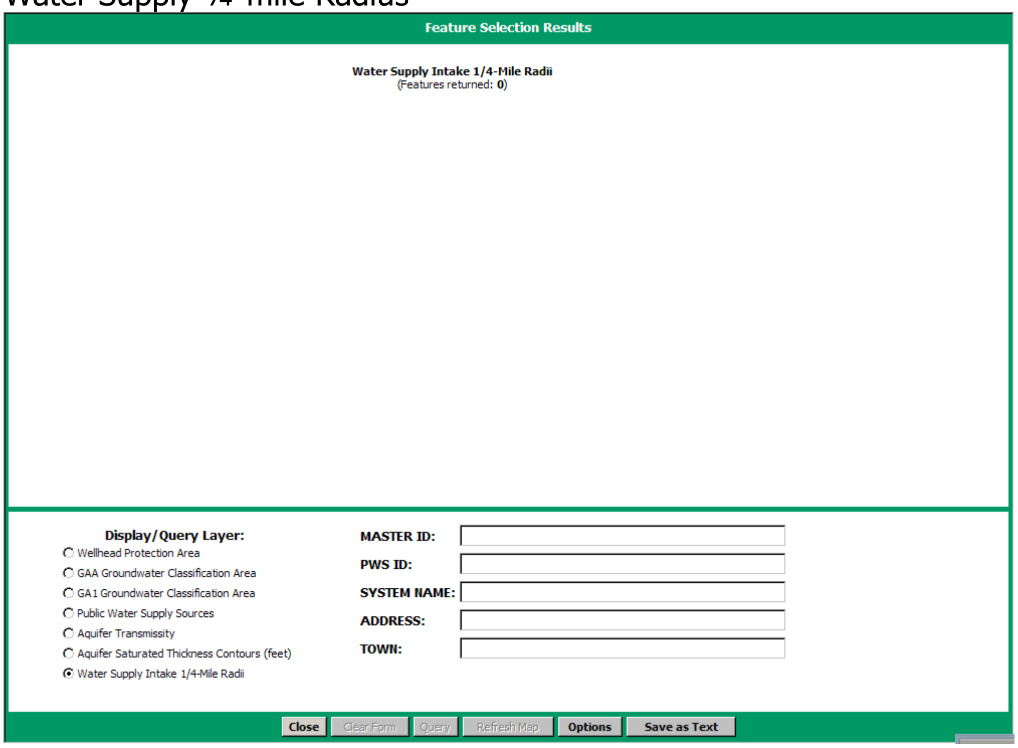
Aquifer Transmissity



Aquifer Saturated Thickness Contours (feet)



Water Supply ¼-mile Radius



2.9 NHB Letter/Response

Memo

NH NATURAL HERITAGE BUREAU
NHB DATACHECK RESULTS LETTER

To: Chris Hernick, Horizons Engineering, Inc.
34 School St
Littleton, NH 03561

From: Melissa Coppola, NH Natural Heritage Bureau
Date: 10/4/2013 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau
NHB File ID: NHB13-2964 Town: Danbury, Alexandria Location: The project is located in the northern-most section of the Town of Danbury (approximately north of Pillsbury Mountain) and an area of the Town of Alexandria between said section of Danbury and the national electric grid power lines adjacent to Bog Road.

Description: Iberdrola Renewables wishes to construct a 23 turbine wind farm along ridgelines in the towns of Danbury and Alexandria. The project also includes the construction of an operations and maintenance area, an electrical substation, and transmission lines.

cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: NHB is requesting surveys for the sensitive plant species. Please contact NHB for further details about the particular habitats that should be searched.

Natural Community	State[1]	Federal	Notes
Medium level fen system	--	--	Level fens are stagnant, and as such are characterized by low nutrient levels, relatively high acidity levels, and accumulations of peat. The primary threats to this community are changes to its hydrology (especially that which causes pooling), increased nutrient input from stormwater runoff, and sedimentation from nearby disturbance.
Sensitive Plant Species (not public information)			Please contact NHB to request details about this species. NHB recommends surveys where appropriate habitat exists.

Vertebrate species	State[1]	Federal	Notes
Sensitive Wildlife Habitat	--	--	Contact the NH Fish & Game Dept (see below).

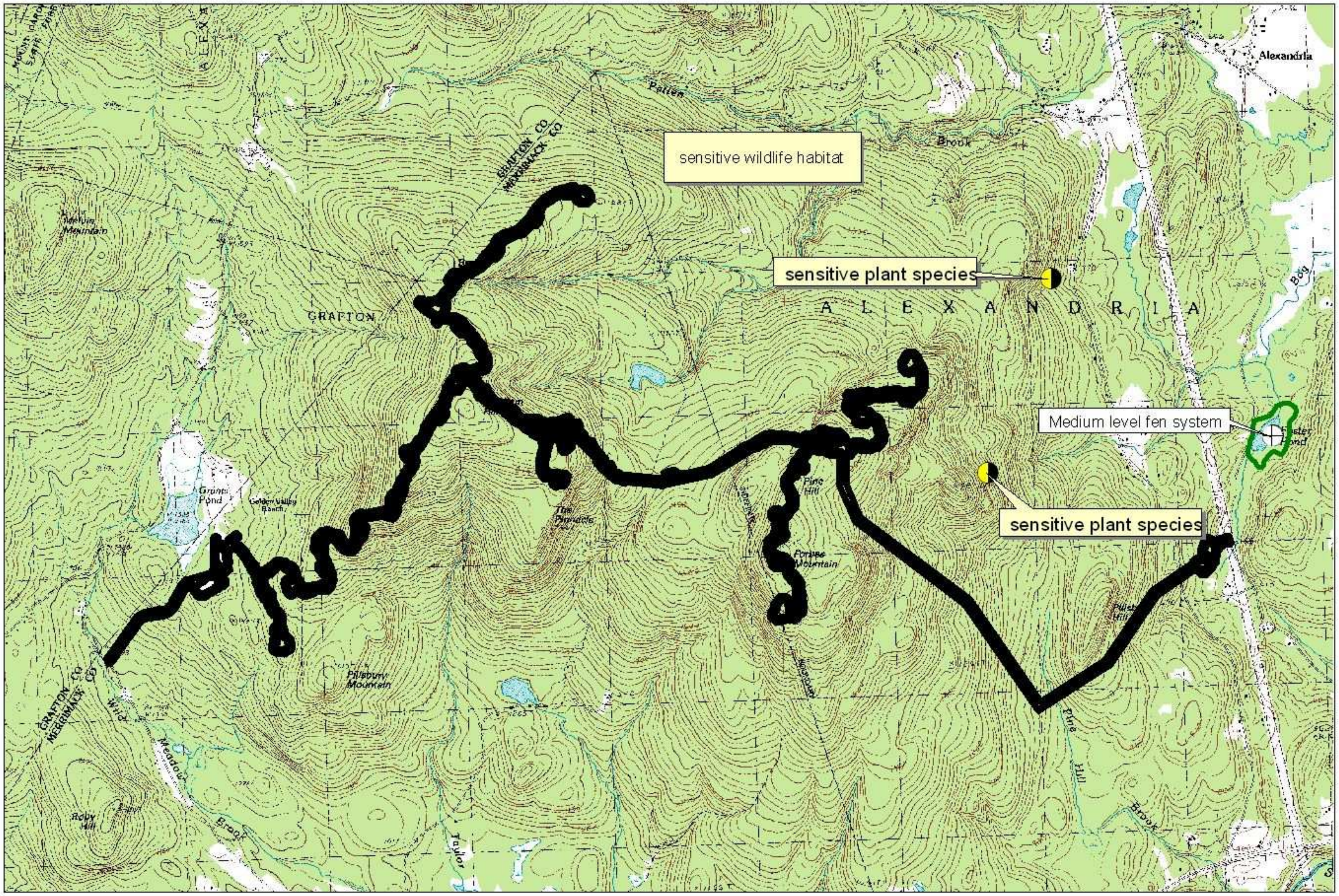
[1]Codes: "E" = Endangered, "T" = Threatened, “SC” = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

NHB13-2964

NH Natural Heritage Bureau



1:39000

Valid for one year from this date: 04 Oct 2013

New Hampshire Natural Heritage Bureau - System Record

Medium level fen system

Legal Status		**Conservation Status**	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Rare or uncommon

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).
Comments on Rank:

Detailed Description: 1992: A small example of this natural community with some northern (*Ledum groenlandicum*, *Abies balsamea*) and southern (*Woodwardia virginica*, *Toxicodendron vernix*, *Peltandra virginica*) affinities. No rare flora found. Overall, community in excellent condition.

General Area:
General Comments:
Management Comments:

Location

Survey Site Name: Alexandria Bog
Managed By:

County:	Grafton	USGS quad(s):	Danbury (4307157)
Town(s):	Alexandria	Lat, Long:	433519N, 0714727W
Size:	21.2 acres	Elevation:	605 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

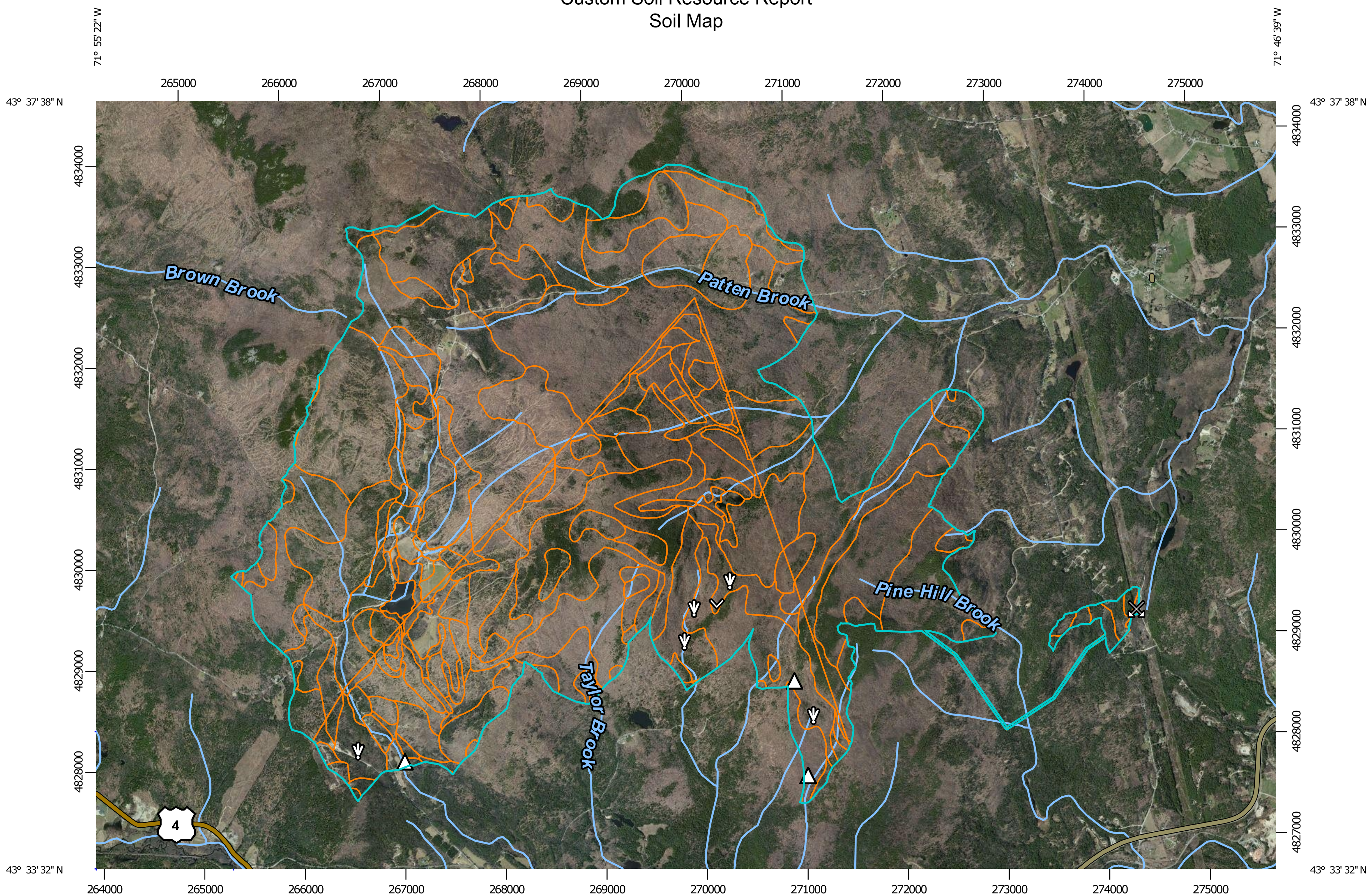
Directions: From Bristol, take Rte 104 west about 1 mile. Bear right onto Pattee Hill Road. Soon, turn right onto Akita Road. Follow Akita Road ca. 0.75 miles to site. Access Foster Pond "Fen" by canoe, or by foot from east upland edge.

Dates documented

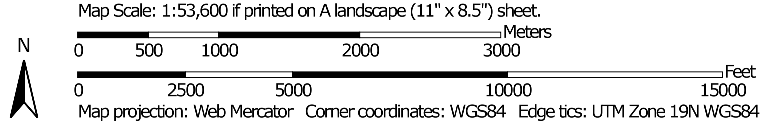
First reported: 1992-08-31 Last reported: 1993-06-18

2.10 NRCS Soils Information
(Web Soils Survey Map)

Soil Map



Map Scale: 1:53,600 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grafton County, New Hampshire
Survey Area Data: Version 15, Aug 27, 2012

Soil Survey Area: Merrimack and Belknap Counties, New Hampshire
Survey Area Data: Version 17, Oct 27, 2009

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 8, 2011—Oct 8, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Grafton County, New Hampshire (NH009)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
28A	Madawaska fine sandy loam, 0 to 3 percent slopes	18.2	0.3%
36B	Adams loamy sand, 3 to 8 percent slopes	4.7	0.1%
36C	Adams loamy sand, 8 to 15 percent slopes	2.9	0.0%
36E	Adams loamy sand, 15 to 60 percent slopes	8.4	0.1%
57E	Becket fine sandy loam, 25 to 35 percent slopes, very stony	2.2	0.0%
59B	Waumbek loamy sand, 3 to 8 percent slopes, very stony	9.2	0.1%
61D	Tunbridge-Lyman-Rock outcrop complex, 15 to 25 percent slopes	16.8	0.2%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	37.7	0.5%
72B	Berkshire loam, 3 to 8 percent slopes	7.1	0.1%
72C	Berkshire loam, 8 to 15 percent slopes	15.3	0.2%
73B	Berkshire loam, 3 to 8 percent slopes, very stony	13.2	0.2%
90B	Tunbridge-Lyman complex, 3 to 8 percent slopes	4.2	0.1%
90C	Tunbridge-Lyman complex, 8 to 15 percent slopes	57.4	0.8%
90D	Tunbridge-Lyman complex, 15 to 25 percent slopes	98.6	1.4%
254C	Monadnock and Hermon soils, 8 to 15 percent slopes	7.1	0.1%
255E	Monadnock and Hermon soils, 25 to 35 percent slopes, very stony	16.2	0.2%
347A	Lyme and Moosilauke soils, 0 to 3 percent slopes, very stony	4.5	0.1%
395	Chocorua mucky peat	16.8	0.2%
701B	Becket-Skerry association, gently sloping, very stony	213.2	3.0%
703E	Becket-Monadnock association, steep, very stony	66.9	0.9%
709D	Becket-Tunbridge association, hilly, very stony	906.5	12.6%

Grafton County, New Hampshire (NH009)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
709E	Becket-Tunbridge association, steep, very stony	86.2	1.2%
710D	Becket-Lyman-Rock outcrop complex, hilly	455.6	6.4%
710E	Becket-Lyman-Rock outcrop complex, steep	392.6	5.5%
711B	Monadnock-Hermon association, undulating, very stony	130.1	1.8%
711D	Monadnock-Hermon association, hilly, very stony	0.1	0.0%
712B	Hermon-Monadnock association, undulating, extremely bouldery	306.9	4.3%
712D	Hermon-Monadnock association, hilly, extremely bouldery	171.3	2.4%
713B	Hermon-Waumbek association, undulating, very stony	7.0	0.1%
713D	Hermon-Waumbek association, hilly, very stony	27.6	0.4%
717	Lyme-Peacham association, very stony	1.0	0.0%
720D	Marlow-Lyman-Rock outcrop complex, hilly	438.7	6.1%
721B	Peru-Marlow association, gently sloping, very stony	469.7	6.5%
723B	Peru-Pillsbury association, gently sloping, very stony	51.4	0.7%
724B	Skerry-Tunbridge association, undulating, very stony	116.8	1.6%
726D	Rock outcrop-Lyman complex, hilly	7.8	0.1%
729B	Waumbek-Lyme association, undulating, very stony	59.3	0.8%
730B	Skerry-Lyman-Rock outcrop complex, undulating	216.5	3.0%
819B	Peru-Tunbridge association, undulating, very stony	32.3	0.5%
W	Water	19.0	0.3%
Subtotals for Soil Survey Area		**4,516.9**	**63.0%**
Totals for Area of Interest		**7,170.9**	**100.0%**

Merrimack and Belknap Counties, New Hampshire (NH609)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
17A	Searsport-Chocorua-Naumburg complex, 0 to 1 percent slopes	8.2	0.1%

Merrimack and Belknap Counties, New Hampshire (NH609)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
55E	Hermon fine sandy loam, 25 to 35 percent slopes, very stony	217.4	3.0%
56C	Becket fine sandy loam, 8 to 15 percent slopes	2.3	0.0%
57B	Becket fine sandy loam, 3 to 8 percent slopes, very stony	4.9	0.1%
57C	Becket fine sandy loam, 8 to 15 percent slopes, very stony	23.1	0.3%
57D	Becket fine sandy loam, 15 to 25 percent slopes, very stony	19.1	0.3%
57E	Becket fine sandy loam, 25 to 35 percent slopes, very stony	24.3	0.3%
77D	Marlow fine sandy loam, 15 to 25 percent slopes, very stony	44.4	0.6%
77E	Marlow fine sandy loam, 25 to 35 percent slopes, very stony	23.5	0.3%
105A	Rumney very fine sandy loam, 0 to 3 percent slopes, frequently flooded	13.5	0.2%
143B	Monadnock sandy loam, 3 to 8 percent slopes, very stony	62.3	0.9%
143D	Monadnock sandy loam, 15 to 25 percent slopes, very stony	179.4	2.5%
143E	Monadnock sandy loam, 25 to 35 percent slopes, very stony	325.9	4.5%
161C	Lyman-Tunbridge-Rock outcrop complex, 8 to 15 percent slopes	113.7	1.6%
161D	Lyman-Tunbridge-Rock outcrop complex, 15 to 35 percent slopes	59.1	0.8%
161E	Lyman-Tunbridge-Rock outcrop complex, 35 to 60 percent slopes	472.8	6.6%
244D	Hermon-Monadnock Complex, 15 to 25 percent slopes, very stony	23.3	0.3%
379B	Dixfield fine sandy loam, 3 to 8 percent slopes, very stony	114.3	1.6%
379C	Dixfield fine sandy loam, 8 to 15 percent slopes, very stony	36.8	0.5%
380B	Tunbridge-Lyman-Becket complex, 3 to 8 percent slopes, very stony	9.5	0.1%
380C	Tunbridge-Lyman-Becket complex, 8 to 15 percent slopes, very stony	27.2	0.4%
380D	Tunbridge-Lyman-Becket complex, 15 to 25 percent slopes, very stony	179.9	2.5%

Merrimack and Belknap Counties, New Hampshire (NH609)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
380E	Tunbridge-Lyman-Becket complex, 25 to 60 percent slopes, very stony	96.5	1.3%
394A	Chocorua mucky peat, 0 to 1 percent slopes	16.2	0.2%
399E	Rock outcrop, 3 to 80 percent slopes	15.5	0.2%
415B	Moosilauke fine sandy loam, 3 to 8 percent slopes, very stony	26.6	0.4%
543C	Monadnock-Becket-Skerry complex, 8 to 15 percent slopes, very stony	18.3	0.3%
559B	Skerry fine sandy loam, 3 to 8 percent slopes, very stony	131.3	1.8%
559C	Skerry fine sandy loam, 8 to 15 percent slopes, very stony	46.6	0.7%
559D	Skerry fine sandy loam, 15 to 25 percent slopes, very stony	242.8	3.4%
647B	Pillsbury sandy loam, 3 to 8 percent slopes, very stony	56.2	0.8%
649A	Peacham cobbly mucky fine sandy loam, 0 to 1 percent slopes, extremely stony	9.8	0.1%
W	Water	9.4	0.1%
Subtotals for Soil Survey Area		**2,654.0**	**37.0%**
Totals for Area of Interest		**7,170.9**	**100.0%**

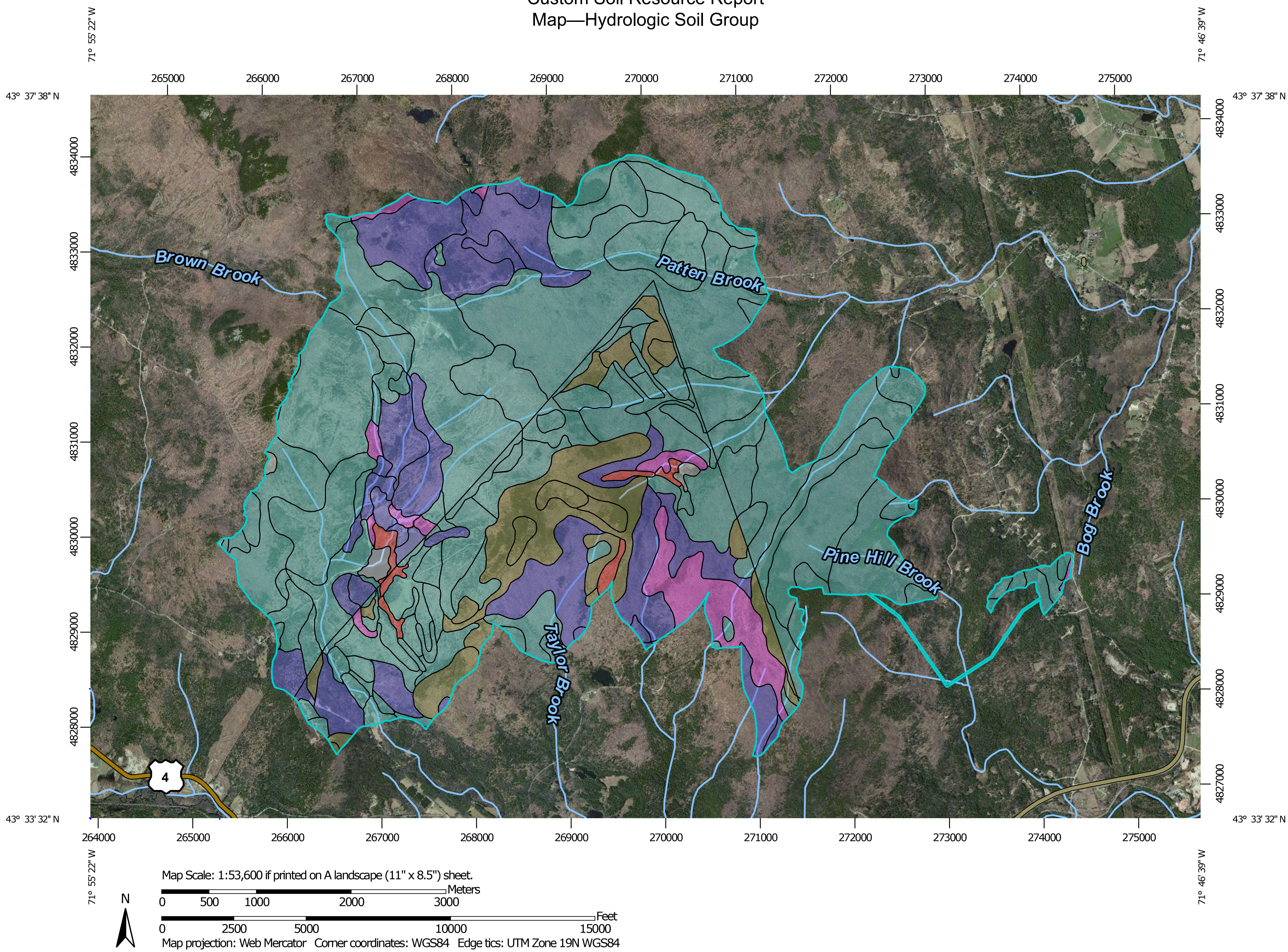
Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a

Map—Hydrologic Soil Group



Map Scale: 1:53,600 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Merrimack and Belknap Counties, New Hampshire
Survey Area Data: Version 17, Oct 27, 2009

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 8, 2011—Oct 8, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire (NH009)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
28A	Madawaska fine sandy loam, 0 to 3 percent slopes	B	18.2	0.3%
36B	Adams loamy sand, 3 to 8 percent slopes	A	4.7	0.1%
36C	Adams loamy sand, 8 to 15 percent slopes	A	2.9	0.0%
36E	Adams loamy sand, 15 to 60 percent slopes	A	8.4	0.1%
57E	Becket fine sandy loam, 25 to 35 percent slopes, very stony	C	2.2	0.0%
59B	Waumbek loamy sand, 3 to 8 percent slopes, very stony	B	9.2	0.1%
61D	Tunbridge-Lyman-Rock outcrop complex, 15 to 25 percent slopes	C	16.8	0.2%
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes	C	37.7	0.5%
72B	Berkshire loam, 3 to 8 percent slopes	B	7.1	0.1%
72C	Berkshire loam, 8 to 15 percent slopes	B	15.3	0.2%
73B	Berkshire loam, 3 to 8 percent slopes, very stony	B	13.2	0.2%
90B	Tunbridge-Lyman complex, 3 to 8 percent slopes	C	4.2	0.1%
90C	Tunbridge-Lyman complex, 8 to 15 percent slopes	C	57.4	0.8%
90D	Tunbridge-Lyman complex, 15 to 25 percent slopes	C	98.6	1.4%
254C	Monadnock and Hermon soils, 8 to 15 percent slopes	B	7.1	0.1%
255E	Monadnock and Hermon soils, 25 to 35 percent slopes, very stony	B	16.2	0.2%
347A	Lyme and Moosilauke soils, 0 to 3 percent slopes, very stony	C	4.5	0.1%
395	Chocorua mucky peat	D	16.8	0.2%

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire (NH009)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
701B	Becket-Skerry association, gently sloping, very stony	C	213.2	3.0%
703E	Becket-Monadnock association, steep, very stony	C	66.9	0.9%
709D	Becket-Tunbridge association, hilly, very stony	C	906.5	12.6%
709E	Becket-Tunbridge association, steep, very stony	C	86.2	1.2%
710D	Becket-Lyman-Rock outcrop complex, hilly	C	455.6	6.4%
710E	Becket-Lyman-Rock outcrop complex, steep	C	392.6	5.5%
711B	Monadnock-Hermon association, undulating, very stony	B	130.1	1.8%
711D	Monadnock-Hermon association, hilly, very stony	B	0.1	0.0%
712B	Hermon-Monadnock association, undulating, extremely bouldery	B	306.9	4.3%
712D	Hermon-Monadnock association, hilly, extremely bouldery	B	171.3	2.4%
713B	Hermon-Waumbek association, undulating, very stony	A	7.0	0.1%
713D	Hermon-Waumbek association, hilly, very stony	A	27.6	0.4%
717	Lyme-Peacham association, very stony	C	1.0	0.0%
720D	Marlow-Lyman-Rock outcrop complex, hilly	C	438.7	6.1%
721B	Peru-Marlow association, gently sloping, very stony	C	469.7	6.5%
723B	Peru-Pillsbury association, gently sloping, very stony	C	51.4	0.7%
724B	Skerry-Tunbridge association, undulating, very stony	C	116.8	1.6%
726D	Rock outcrop-Lyman complex, hilly		7.8	0.1%

Hydrologic Soil Group— Summary by Map Unit — Grafton County, New Hampshire (NH009)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
729B	Waumbek-Lyme association, undulating, very stony	B	59.3	0.8%
730B	Skerry-Lyman-Rock outcrop complex, undulating	C	216.5	3.0%
819B	Peru-Tunbridge association, undulating, very stony	C	32.3	0.5%
W	Water		19.0	0.3%
Subtotals for Soil Survey Area			**4,516.9**	**63.0%**
Totals for Area of Interest			**7,170.9**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — Merrimack and Belknap Counties, New Hampshire (NH609)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
17A	Searsport-Chocorua-Naumburg complex, 0 to 1 percent slopes	D	8.2	0.1%
55E	Hermon fine sandy loam, 25 to 35 percent slopes, very stony	A	217.4	3.0%
56C	Becket fine sandy loam, 8 to 15 percent slopes	C	2.3	0.0%
57B	Becket fine sandy loam, 3 to 8 percent slopes, very stony	C	4.9	0.1%
57C	Becket fine sandy loam, 8 to 15 percent slopes, very stony	C	23.1	0.3%
57D	Becket fine sandy loam, 15 to 25 percent slopes, very stony	C	19.1	0.3%
57E	Becket fine sandy loam, 25 to 35 percent slopes, very stony	C	24.3	0.3%
77D	Marlow fine sandy loam, 15 to 25 percent slopes, very stony	C	44.4	0.6%
77E	Marlow fine sandy loam, 25 to 35 percent slopes, very stony	C	23.5	0.3%
105A	Rumney very fine sandy loam, 0 to 3 percent slopes, frequently flooded	C	13.5	0.2%
143B	Monadnock sandy loam, 3 to 8 percent slopes, very stony	B	62.3	0.9%
143D	Monadnock sandy loam, 15 to 25 percent slopes, very stony	B	179.4	2.5%

Hydrologic Soil Group— Summary by Map Unit — Merrimack and Belknap Counties, New Hampshire (NH609)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
143E	Monadnock sandy loam, 25 to 35 percent slopes, very stony	B	325.9	4.5%
161C	Lyman-Tunbridge-Rock outcrop complex, 8 to 15 percent slopes	C/D	113.7	1.6%
161D	Lyman-Tunbridge-Rock outcrop complex, 15 to 35 percent slopes	C/D	59.1	0.8%
161E	Lyman-Tunbridge-Rock outcrop complex, 35 to 60 percent slopes	C/D	472.8	6.6%
244D	Hermon-Monadnock Complex, 15 to 25 percent slopes, very stony	A	23.3	0.3%
379B	Dixfield fine sandy loam, 3 to 8 percent slopes, very stony	C	114.3	1.6%
379C	Dixfield fine sandy loam, 8 to 15 percent slopes, very stony	C	36.8	0.5%
380B	Tunbridge-Lyman-Becket complex, 3 to 8 percent slopes, very stony	C	9.5	0.1%
380C	Tunbridge-Lyman-Becket complex, 8 to 15 percent slopes, very stony	C	27.2	0.4%
380D	Tunbridge-Lyman-Becket complex, 15 to 25 percent slopes, very stony	C	179.9	2.5%
380E	Tunbridge-Lyman-Becket complex, 25 to 60 percent slopes, very stony	C	96.5	1.3%
394A	Chocorua mucky peat, 0 to 1 percent slopes	D	16.2	0.2%
399E	Rock outcrop, 3 to 80 percent slopes	D	15.5	0.2%
415B	Moosilauke fine sandy loam, 3 to 8 percent slopes, very stony	C	26.6	0.4%
543C	Monadnock-Becket-Skerry complex, 8 to 15 percent slopes, very stony	C	18.3	0.3%
559B	Skerry fine sandy loam, 3 to 8 percent slopes, very stony	C	131.3	1.8%

Hydrologic Soil Group— Summary by Map Unit — Merrimack and Belknap Counties, New Hampshire (NH609)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
559C	Skerry fine sandy loam, 8 to 15 percent slopes, very stony	C	46.6	0.7%
559D	Skerry fine sandy loam, 15 to 25 percent slopes, very stony	C	242.8	3.4%
647B	Pillsbury sandy loam, 3 to 8 percent slopes, very stony	C	56.2	0.8%
649A	Peacham cobbly mucky fine sandy loam, 0 to 1 percent slopes, extremely stony	D	9.8	0.1%
W	Water		9.4	0.1%
Subtotals for Soil Survey Area			**2,654.0**	**37.0%**
Totals for Area of Interest			**7,170.9**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

2.11 Aerial Photograph

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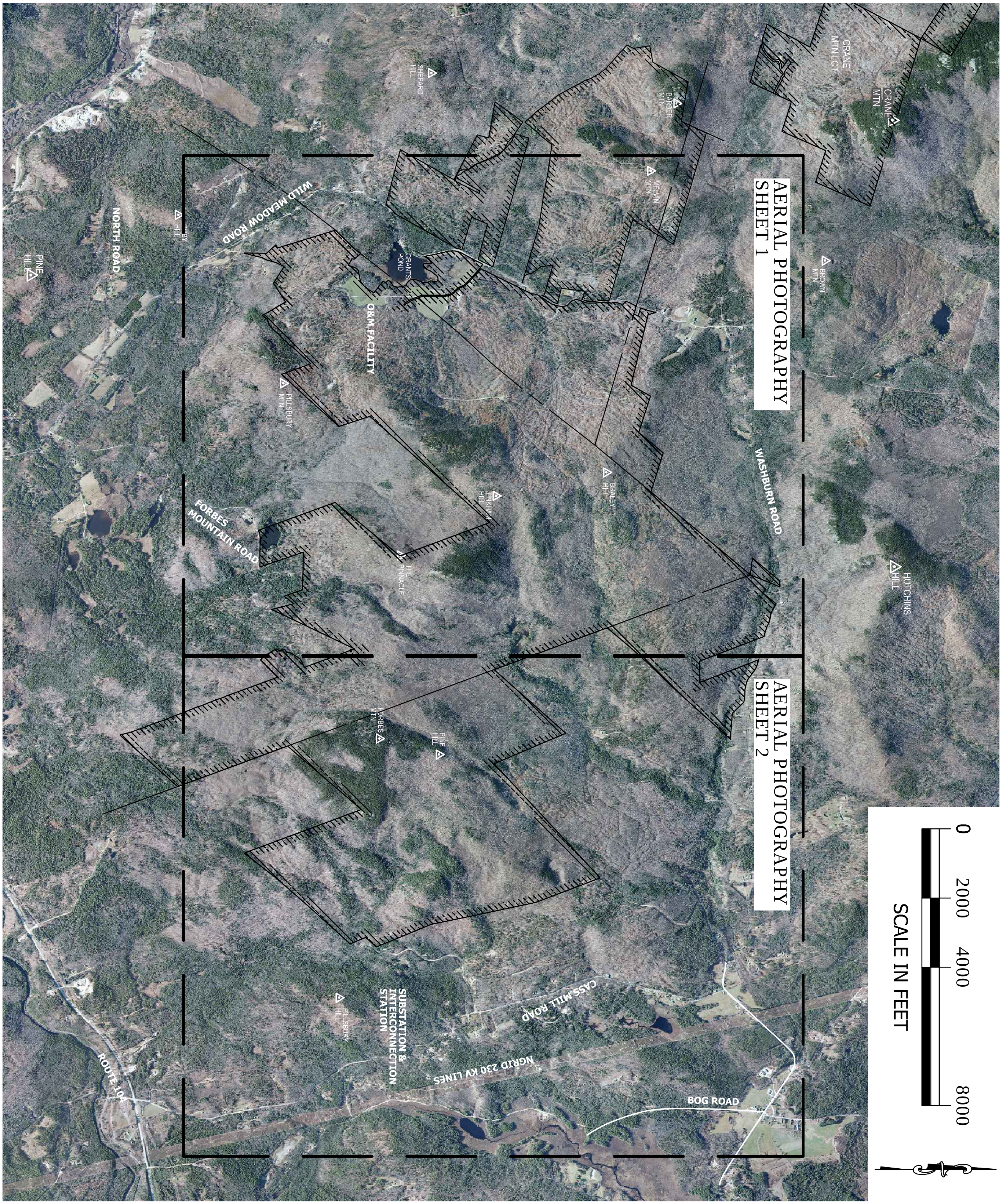

13185

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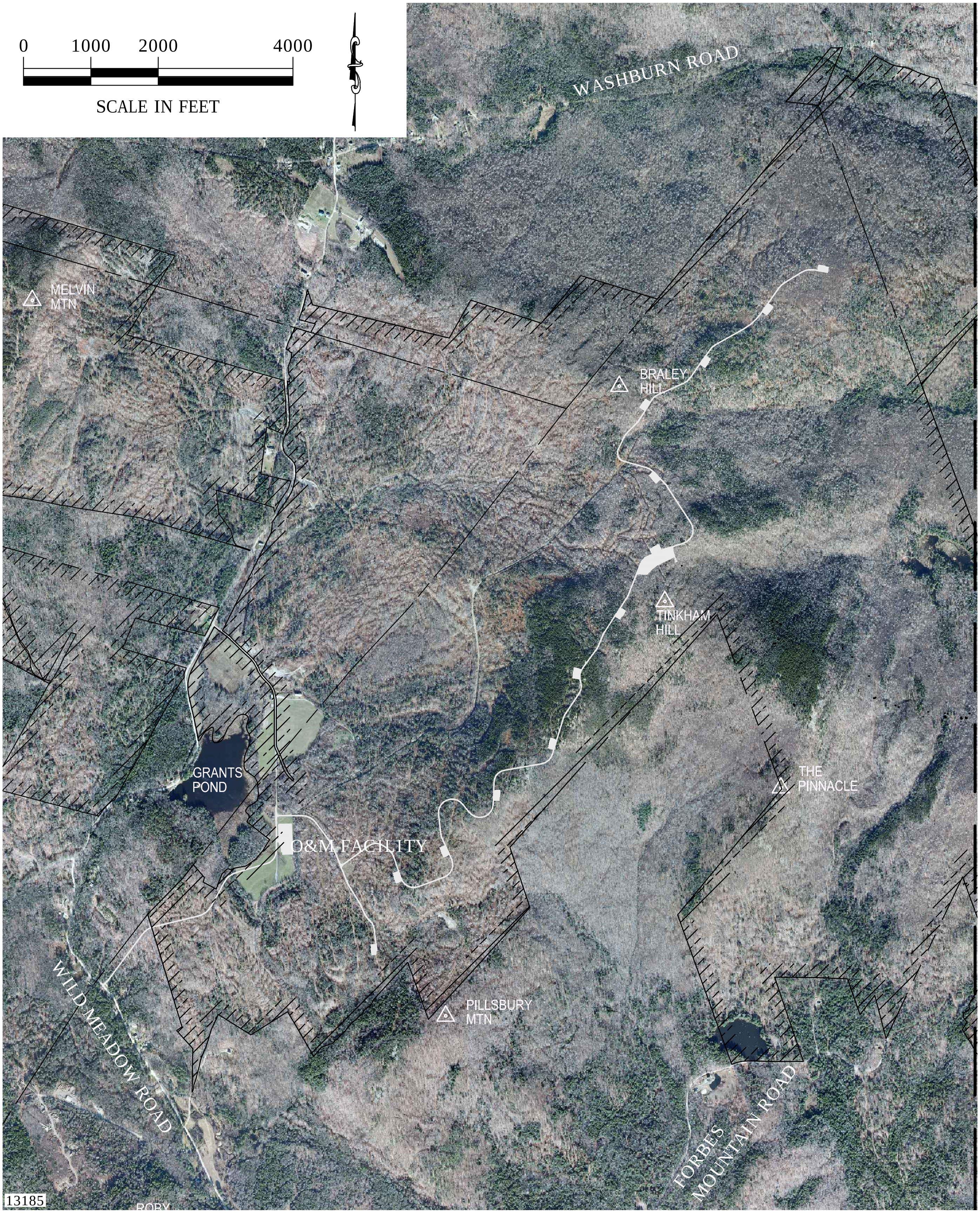
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS
WIND PROJECT
ALEXANDRIA AND DANBURY, NH

AERIAL PHOTOGRAPHY
OVERALL



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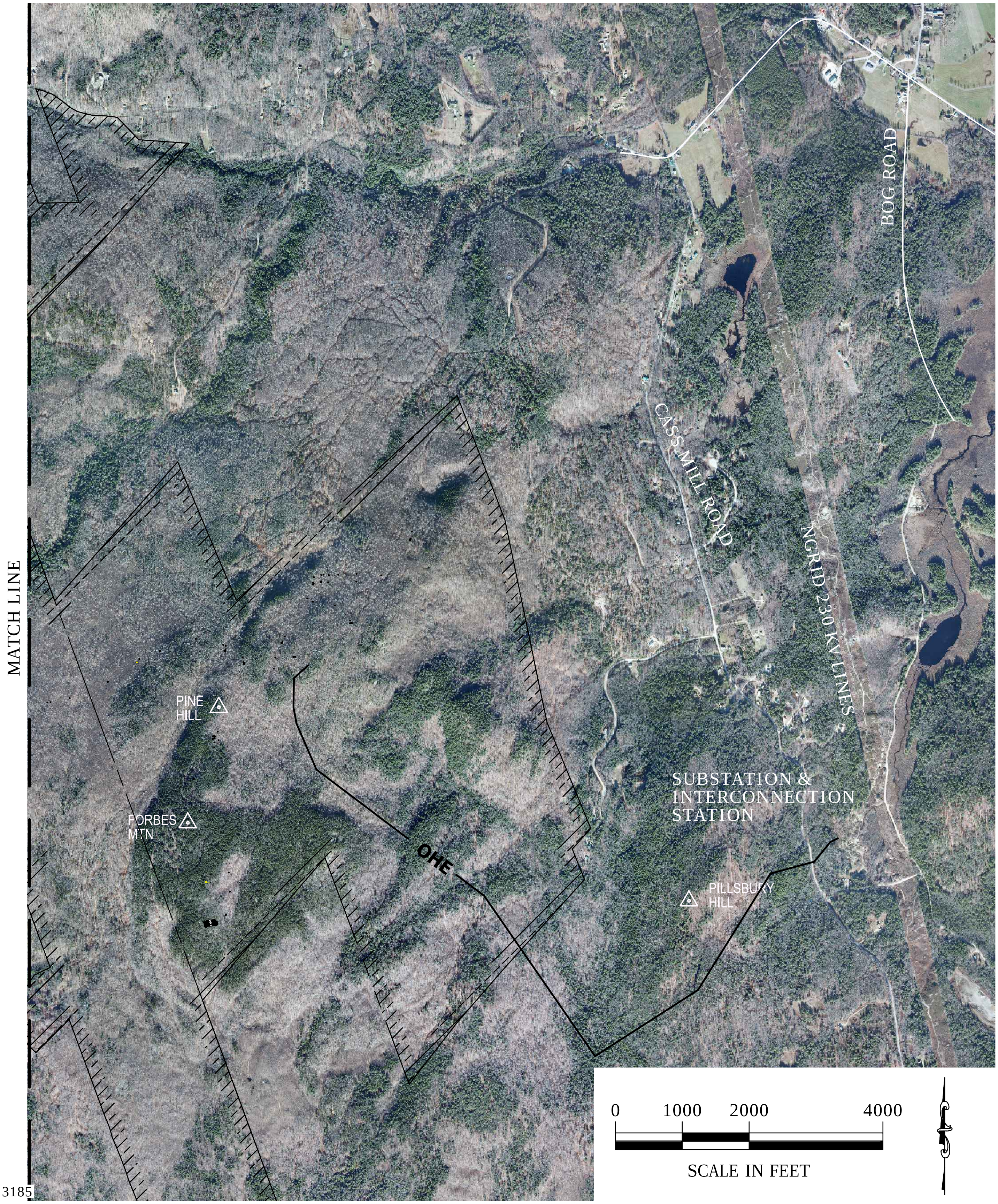
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

AERIAL PHOTOGRAPHY
SHEET 1



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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

AERIAL PHOTOGRAPHY
SHEET 2

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2.12 Site Photographs

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building

PHOTO WAS TAKEN NEAR THE PROPOSED N3 TURBINE LOCATION ALONG CENTRAL CRANE NORTH. PHOTO WAS TAKEN LOOKING SOUTHERLY.

PHOTO DATE: 08-28-12

13185

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

SITE PHOTOS

NOVEMBER 2013

PHOTO WAS TAKEN NEAR STATION 72+00 ALONG THE CENTRAL EAST CONNECTOR, AT A SIGNIFICANT BREAK IN TOPOGRAPHY. PHOTO WAS TAKEN LOOKING NORTH-EASTERLY.

PHOTO DATE: 08-29-12

13185

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

SITE PHOTOS

NOVEMBER 2013

PHOTO WAS TAKEN ALONG THE CENTRAL CRANE SOUTH, NEAR PROPOSED TURBINE LOCATION C-4. PHOTO WAS TAKEN LOOKING SOUTHERLY.

PHOTO DATE: 08-27-12

13185

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

SITE PHOTOS

NOVEMBER 2013

PHOTO WAS TAKEN ALONG THE EAST CRANE SOUTH, NEAR PROPOSED TURBINE LOCATION E-3. PHOTO WAS TAKEN LOOKING EASTERLY.

PHOTO DATE: 08-30-12

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

SITE PHOTOS

NOVEMBER 2013

PHOTO WAS TAKEN IN AN AREA JUST TO THE NORTH OF THE PROPOSED OPERATIONS AND MAINTENACE (O&M) FACILITY FOR THE WILD MEADOWS WIND PROJECT. PHOTO WAS TAKEN LOOKING SOUTHERLY, TOWARDS FUTURE O&M SITE.

PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

PHOTO OM-A
OPERATIONS AND MAINTENANCE
NOVEMBER 2013

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ALEXANDRIA AND DANBURY, NH
PHOTO OM-B
OPERATIONS AND MAINTENANCE
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PHOTO WAS TAKEN IN AN AREA JUST TO THE NORTH OF THE PROPOSED OPERATIONS AND MAINTENACE (O&M) FACILITY FOR THE WILD MEADOWS WIND PROJECT. PHOTO WAS TAKEN LOOKING SOUTHERLY, TOWARDS FUTURE O&M SITE.

PHOTO DATE:10-07-13

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

PHOTO OM-C
OPERATIONS AND MAINTENANCE
NOVEMBER 2013

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PHOTO DATE:10-07-13

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

PHOTO OM-D
OPERATIONS AND MAINTENANCE
NOVEMBER 2013

PHOTO WAS TAKEN FROM BOG ROAD. PHOTO IS OF LARGE WETLAND AREA TO THE SOUTHEAST OF THE PROPOSED SUBSTATION AND INTERCONNECTION STATION. PHOTO WAS TAKEN LOOKING WESTERLY.

PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

PHOTO SS-A
SUBSTATION
NOVEMBER 2013

PHOTO WAS TAKEN FROM BOG ROAD. PHOTO IS OF THE ENTRANCE AREA TO THE PROPOSED SUBSTATION AND INTERCONNECTION STATION. PHOTO LOCATION IS JUST TO THE SOUTH OF THE ENTRANCE. PHOTO WAS TAKEN LOOKING NORTHERLY.

PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

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PHOTO SS-B
SUBSTATION
NOVEMBER 2013

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WILD MEADOWS WIND PROJECT

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PHOTO SS-C
SUBSTATION
NOVEMBER 2013

PHOTO WAS TAKEN FROM BOG ROAD. PHOTO IS OF BOG ROAD. PHOTO LOCATION IS JUST TO THE SOUTH OF THE ENTRANCE TO THE SUBSTATION. PHOTO WAS TAKEN LOOKING SOUTHERLY.

PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

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PHOTO SS-D
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PHOTO WAS TAKEN FROM BOG ROAD. PHOTO IS OF THE AREA WHERE THE ACCESS ROAD TO THE SUBSTATION IS PROPOSED. PHOTO WAS TAKEN LOOKING WESTERLY.

PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

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PHOTO SS-E
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PHOTO WAS TAKEN FROM THE AREA WHERE THE ACCESS ROAD TO THE SUBSTATION IS PROPOSED. PHOTO WAS TAKEN LOOKING EASTERLY, BACK TOWARDS BOG ROAD.

PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

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PHOTO SS-F
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PHOTO WAS TAKEN FROM THE AREA WHERE THE ACCESS ROAD TO THE SUBSTATION IS PROPOSED. PHOTO WAS TAKEN AT THE INTERSECTION OF THE ACCESS ROAD AND A STREAM. PHOTO WAS TAKEN LOOKING NORTHERLY, WHICH IS UPSTREAM.

PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

PHOTO SS-G
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PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

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NOVEMBER 2013

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PHOTO WAS TAKEN FROM THE AREA WHERE THE ACCESS ROAD TO THE SUBSTATION IS PROPOSED. PHOTO WAS TAKEN AT THE INTERSECTION OF THE ACCESS ROAD AND A STREAM. PHOTO WAS TAKEN LOOKING SOUTHWESTERLY.

PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

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PHOTO DATE:8-22-13

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WILD MEADOWS WIND PROJECT

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NOVEMBER 2013

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PHOTO DATE:8-22-13

13185

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

PHOTO SS-K
SUBSTATION
NOVEMBER 2013

2.13 Extreme Precipitation Tables
(Northeast Regional Climate Center)

Wild Meadows Wind Project
Precipitation for Drainage Models

Horizons Engineering Inc.
Project #13185

	Latitude (deg. North)	Longitude (deg. West)	Elevation	2-yr	10-yr	25-yr	50-yr	100-yr
O&M	43.580	71.882	1,358	2.62	3.80	4.71	5.53	6.51
C-9	43.576	71.877	1,441	2.62	3.80	4.71	5.53	6.51
N-1	43.598	71.861	2,111	2.63	3.81	4.71	5.54	6.51
N-4	43.604	71.851	1,872	2.63	3.81	4.71	5.54	6.51
G-1	43.588	71.852	2,126	2.63	3.82	4.72	5.55	6.52
E-1	43.577	71.833	2,001	2.64	3.83	4.74	5.57	6.55
E-4	43.586	71.832	2,114	2.64	3.83	4.74	5.57	6.54
E-8	43.593	71.822	1,651	2.64	3.83	4.74	5.57	6.54
Substation	43.581	71.796	637	2.65	3.85	4.76	5.59	6.58

Conclusion: Use precipitation from Substation (most conservative)

Data From:
Extreme Precipitation Tables from Northeast Regional Climate Center, http://precip.eas.cornell.edu/
24hr Storm "Extreme Precipitation Estimates"
Accessed Monday, September 30, 2013

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.882 degrees West
Latitude	43.580 degrees North
Elevation	1,358 feet
Date/Time	Mon, 30 Sep 2013 13:43:27 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.40	0.49	0.64	0.80	1.01	**1yr**	0.69	0.94	1.16	1.45	1.80	2.24	2.53	**1yr**	1.98	2.44	2.82	3.47	4.03	**1yr**
2yr	0.31	0.48	0.59	0.78	0.98	1.23	**2yr**	0.85	1.12	1.41	1.74	2.14	2.62	2.96	**2yr**	2.32	2.85	3.30	3.96	4.56	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.55	**5yr**	1.06	1.43	1.79	2.20	2.67	3.24	3.70	**5yr**	2.87	3.56	4.10	4.86	5.55	**5yr**
10yr	0.42	0.66	0.83	1.13	1.47	1.86	**10yr**	1.26	1.72	2.14	2.62	3.17	3.80	4.38	**10yr**	3.37	4.21	4.83	5.68	6.44	**10yr**
25yr	0.50	0.79	1.01	1.39	1.84	2.34	**25yr**	1.59	2.19	2.70	3.30	3.97	4.71	5.48	**25yr**	4.17	5.27	6.00	6.99	7.85	**25yr**
50yr	0.57	0.91	1.17	1.63	2.19	2.81	**50yr**	1.89	2.64	3.24	3.94	4.70	5.53	6.49	**50yr**	4.90	6.25	7.08	8.18	9.12	**50yr**
100yr	0.65	1.05	1.35	1.92	2.61	3.36	**100yr**	2.26	3.19	3.87	4.70	5.57	6.51	7.70	**100yr**	5.76	7.40	8.36	9.58	10.59	**100yr**
200yr	0.75	1.22	1.58	2.26	3.11	4.01	**200yr**	2.69	3.85	4.62	5.59	6.59	7.66	9.13	**200yr**	6.78	8.78	9.87	11.23	12.31	**200yr**
500yr	0.90	1.49	1.94	2.81	3.93	5.07	**500yr**	3.39	4.94	5.85	7.04	8.25	9.49	11.45	**500yr**	8.40	11.01	12.30	13.85	15.03	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.43	0.58	0.72	0.88	**1yr**	0.62	0.86	1.01	1.29	1.64	2.05	2.16	**1yr**	1.81	2.08	2.55	2.98	3.29	**1yr**
2yr	0.30	0.46	0.57	0.77	0.95	1.12	**2yr**	0.82	1.09	1.27	1.68	2.16	2.53	2.89	**2yr**	2.24	2.78	3.23	3.87	4.46	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.33	**5yr**	0.98	1.30	1.52	1.96	2.50	3.04	3.44	**5yr**	2.69	3.31	3.81	4.56	5.23	**5yr**
10yr	0.37	0.56	0.70	0.98	1.26	1.50	**10yr**	1.09	1.46	1.72	2.20	2.80	3.44	3.92	**10yr**	3.04	3.77	4.32	5.15	5.90	**10yr**
25yr	0.41	0.62	0.77	1.10	1.44	1.74	**25yr**	1.25	1.70	2.02	2.56	3.26	4.04	4.66	**25yr**	3.58	4.48	5.09	6.06	6.91	**25yr**
50yr	0.43	0.65	0.82	1.17	1.58	1.93	**50yr**	1.36	1.89	2.29	2.85	3.65	4.58	5.31	**50yr**	4.05	5.11	5.76	6.84	7.79	**50yr**
100yr	0.46	0.69	0.87	1.26	1.72	2.14	**100yr**	1.49	2.09	2.60	3.32	4.10	5.17	6.05	**100yr**	4.57	5.81	6.52	7.72	8.78	**100yr**
200yr	0.49	0.73	0.93	1.34	1.87	2.34	**200yr**	1.62	2.29	2.94	3.75	4.69	5.85	6.89	**200yr**	5.18	6.62	7.37	8.73	9.91	**200yr**
500yr	0.53	0.79	1.01	1.47	2.09	2.59	**500yr**	1.80	2.54	3.46	4.41	5.45	6.89	8.20	**500yr**	6.10	7.88	8.66	10.26	11.65	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.44	0.53	0.72	0.88	1.04	**1yr**	0.76	1.02	1.18	1.53	1.92	2.45	2.79	**1yr**	2.17	2.68	3.10	3.76	4.32	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.22	**2yr**	0.91	1.19	1.38	1.79	2.30	2.76	3.06	**2yr**	2.44	2.94	3.42	4.07	4.67	**2yr**
5yr	0.41	0.62	0.78	1.06	1.35	1.62	**5yr**	1.17	1.59	1.82	2.27	2.87	3.46	3.98	**5yr**	3.06	3.83	4.40	5.18	5.89	**5yr**
10yr	0.49	0.75	0.93	1.30	1.69	2.04	**10yr**	1.45	1.99	2.26	2.69	3.39	4.16	4.88	**10yr**	3.68	4.70	5.35	6.25	7.03	**10yr**
25yr	0.63	0.96	1.20	1.71	2.25	2.79	**25yr**	1.94	2.73	3.03	3.45	4.30	5.33	6.41	**25yr**	4.72	6.16	6.93	7.99	8.89	**25yr**
50yr	0.76	1.16	1.45	2.08	2.80	3.55	**50yr**	2.42	3.47	3.78	4.16	5.16	6.43	7.88	**50yr**	5.69	7.57	8.45	9.66	10.62	**50yr**
100yr	0.93	1.41	1.77	2.56	3.51	4.54	**100yr**	3.03	4.43	4.73	5.42	6.19	7.77	9.67	**100yr**	6.88	9.30	10.32	11.68	12.69	**100yr**
200yr	1.14	1.71	2.17	3.14	4.38	5.81	**200yr**	3.78	5.68	5.91	6.60	8.65	9.40	11.88	**200yr**	8.32	11.42	12.59	14.13	15.18	**200yr**
500yr	1.49	2.21	2.85	4.14	5.88	8.10	**500yr**	5.08	7.92	7.96	8.57	11.33	12.08	15.63	**500yr**	10.69	15.03	16.42	18.20	19.22	**500yr**

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Northeast Regional Climate Center

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.877 degrees West
Latitude	43.576 degrees North
Elevation	1,441 feet
Date/Time	Mon, 30 Sep 2013 13:47:14 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.40	0.49	0.64	0.80	1.01	**1yr**	0.69	0.94	1.16	1.45	1.80	2.24	2.53	**1yr**	1.98	2.44	2.82	3.47	4.03	**1yr**
2yr	0.31	0.48	0.59	0.78	0.98	1.23	**2yr**	0.85	1.12	1.41	1.74	2.14	2.62	2.96	**2yr**	2.32	2.85	3.30	3.96	4.56	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.55	**5yr**	1.06	1.43	1.79	2.20	2.67	3.24	3.70	**5yr**	2.87	3.56	4.10	4.86	5.55	**5yr**
10yr	0.42	0.66	0.83	1.13	1.47	1.86	**10yr**	1.26	1.72	2.14	2.62	3.17	3.80	4.38	**10yr**	3.37	4.21	4.83	5.68	6.44	**10yr**
25yr	0.50	0.79	1.01	1.39	1.84	2.34	**25yr**	1.59	2.19	2.70	3.30	3.97	4.71	5.48	**25yr**	4.17	5.27	6.00	6.99	7.85	**25yr**
50yr	0.57	0.91	1.17	1.63	2.19	2.81	**50yr**	1.89	2.64	3.24	3.94	4.70	5.53	6.49	**50yr**	4.90	6.25	7.08	8.18	9.12	**50yr**
100yr	0.65	1.05	1.35	1.92	2.61	3.36	**100yr**	2.26	3.19	3.87	4.70	5.57	6.51	7.70	**100yr**	5.76	7.40	8.36	9.58	10.59	**100yr**
200yr	0.75	1.22	1.58	2.26	3.11	4.01	**200yr**	2.69	3.85	4.62	5.59	6.59	7.66	9.13	**200yr**	6.78	8.78	9.87	11.23	12.31	**200yr**
500yr	0.90	1.49	1.94	2.81	3.93	5.07	**500yr**	3.39	4.94	5.85	7.04	8.25	9.49	11.45	**500yr**	8.40	11.01	12.30	13.85	15.03	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.43	0.58	0.72	0.88	**1yr**	0.62	0.86	1.01	1.29	1.64	2.05	2.16	**1yr**	1.81	2.08	2.55	2.98	3.29	**1yr**
2yr	0.30	0.46	0.57	0.77	0.95	1.12	**2yr**	0.82	1.09	1.27	1.68	2.16	2.53	2.89	**2yr**	2.24	2.78	3.23	3.87	4.46	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.33	**5yr**	0.98	1.30	1.52	1.96	2.50	3.04	3.44	**5yr**	2.69	3.31	3.81	4.56	5.23	**5yr**
10yr	0.37	0.56	0.70	0.98	1.26	1.50	**10yr**	1.09	1.46	1.72	2.20	2.80	3.44	3.92	**10yr**	3.04	3.77	4.32	5.15	5.90	**10yr**
25yr	0.41	0.62	0.77	1.10	1.44	1.74	**25yr**	1.25	1.70	2.02	2.56	3.26	4.04	4.66	**25yr**	3.58	4.48	5.09	6.06	6.91	**25yr**
50yr	0.43	0.65	0.82	1.17	1.58	1.93	**50yr**	1.36	1.89	2.29	2.85	3.65	4.58	5.31	**50yr**	4.05	5.11	5.76	6.84	7.79	**50yr**
100yr	0.46	0.69	0.87	1.26	1.72	2.14	**100yr**	1.49	2.09	2.60	3.32	4.10	5.17	6.05	**100yr**	4.57	5.81	6.52	7.72	8.78	**100yr**
200yr	0.49	0.73	0.93	1.34	1.87	2.34	**200yr**	1.62	2.29	2.94	3.75	4.69	5.85	6.89	**200yr**	5.18	6.62	7.37	8.73	9.91	**200yr**
500yr	0.53	0.79	1.01	1.47	2.09	2.59	**500yr**	1.80	2.54	3.46	4.41	5.45	6.89	8.20	**500yr**	6.10	7.88	8.66	10.26	11.65	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.44	0.53	0.72	0.88	1.04	**1yr**	0.76	1.02	1.18	1.53	1.92	2.45	2.79	**1yr**	2.17	2.68	3.10	3.76	4.32	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.22	**2yr**	0.91	1.19	1.38	1.79	2.30	2.76	3.06	**2yr**	2.44	2.94	3.42	4.07	4.67	**2yr**
5yr	0.41	0.62	0.78	1.06	1.35	1.62	**5yr**	1.17	1.59	1.82	2.27	2.87	3.46	3.98	**5yr**	3.06	3.83	4.40	5.18	5.89	**5yr**
10yr	0.49	0.75	0.93	1.30	1.69	2.04	**10yr**	1.45	1.99	2.26	2.69	3.39	4.16	4.88	**10yr**	3.68	4.70	5.35	6.25	7.03	**10yr**
25yr	0.63	0.96	1.20	1.71	2.25	2.79	**25yr**	1.94	2.73	3.03	3.45	4.30	5.33	6.41	**25yr**	4.72	6.16	6.93	7.99	8.89	**25yr**
50yr	0.76	1.16	1.45	2.08	2.80	3.55	**50yr**	2.42	3.47	3.78	4.16	5.16	6.43	7.88	**50yr**	5.69	7.57	8.45	9.66	10.62	**50yr**
100yr	0.93	1.41	1.77	2.56	3.51	4.54	**100yr**	3.03	4.43	4.73	5.42	6.19	7.77	9.67	**100yr**	6.88	9.30	10.32	11.68	12.69	**100yr**
200yr	1.14	1.71	2.17	3.14	4.38	5.81	**200yr**	3.78	5.68	5.91	6.60	8.65	9.40	11.88	**200yr**	8.32	11.42	12.59	14.13	15.18	**200yr**
500yr	1.49	2.21	2.85	4.14	5.88	8.10	**500yr**	5.08	7.92	7.96	8.57	11.33	12.08	15.63	**500yr**	10.69	15.03	16.42	18.20	19.22	**500yr**

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Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.861 degrees West
Latitude	43.598 degrees North
Elevation	2,111 feet
Date/Time	Mon, 30 Sep 2013 13:48:53 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.39	0.49	0.64	0.80	1.01	**1yr**	0.69	0.94	1.16	1.45	1.80	2.24	2.53	**1yr**	1.99	2.44	2.82	3.48	4.03	**1yr**
2yr	0.31	0.47	0.59	0.78	0.98	1.23	**2yr**	0.85	1.12	1.41	1.74	2.14	2.63	2.97	**2yr**	2.32	2.85	3.31	3.96	4.57	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.55	**5yr**	1.06	1.43	1.79	2.20	2.68	3.24	3.71	**5yr**	2.87	3.57	4.10	4.87	5.56	**5yr**
10yr	0.42	0.66	0.83	1.13	1.47	1.86	**10yr**	1.26	1.72	2.14	2.62	3.17	3.81	4.39	**10yr**	3.37	4.22	4.83	5.69	6.45	**10yr**
25yr	0.50	0.79	1.01	1.39	1.84	2.35	**25yr**	1.59	2.20	2.70	3.30	3.97	4.71	5.49	**25yr**	4.17	5.28	5.99	6.99	7.86	**25yr**
50yr	0.57	0.91	1.17	1.64	2.19	2.81	**50yr**	1.89	2.65	3.24	3.94	4.70	5.54	6.50	**50yr**	4.90	6.25	7.06	8.18	9.13	**50yr**
100yr	0.65	1.05	1.35	1.92	2.62	3.36	**100yr**	2.26	3.20	3.88	4.70	5.57	6.51	7.71	**100yr**	5.76	7.41	8.33	9.57	10.60	**100yr**
200yr	0.75	1.22	1.58	2.26	3.12	4.01	**200yr**	2.69	3.87	4.63	5.59	6.60	7.66	9.14	**200yr**	6.78	8.79	9.82	11.21	12.32	**200yr**
500yr	0.90	1.49	1.94	2.81	3.93	5.08	**500yr**	3.39	4.97	5.86	7.04	8.25	9.49	11.46	**500yr**	8.40	11.02	12.23	13.82	15.04	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.44	0.59	0.73	0.88	**1yr**	0.63	0.86	1.01	1.29	1.64	2.06	2.16	**1yr**	1.82	2.08	2.53	2.99	3.32	**1yr**
2yr	0.30	0.46	0.57	0.77	0.95	1.11	**2yr**	0.82	1.09	1.27	1.68	2.15	2.54	2.90	**2yr**	2.25	2.78	3.24	3.88	4.47	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.33	**5yr**	0.98	1.30	1.52	1.96	2.50	3.05	3.45	**5yr**	2.70	3.32	3.82	4.57	5.24	**5yr**
10yr	0.37	0.56	0.70	0.98	1.26	1.50	**10yr**	1.09	1.47	1.71	2.19	2.80	3.45	3.94	**10yr**	3.05	3.78	4.34	5.17	5.92	**10yr**
25yr	0.40	0.62	0.77	1.09	1.44	1.75	**25yr**	1.24	1.71	2.02	2.55	3.27	4.06	4.68	**25yr**	3.60	4.50	5.12	6.09	6.93	**25yr**
50yr	0.43	0.66	0.82	1.17	1.58	1.95	**50yr**	1.36	1.90	2.29	2.85	3.66	4.61	5.33	**50yr**	4.08	5.13	5.80	6.89	7.82	**50yr**
100yr	0.46	0.70	0.88	1.26	1.73	2.16	**100yr**	1.50	2.11	2.60	3.32	4.13	5.21	6.08	**100yr**	4.61	5.85	6.58	7.79	8.83	**100yr**
200yr	0.49	0.74	0.94	1.36	1.89	2.37	**200yr**	1.64	2.32	2.94	3.76	4.74	5.91	6.93	**200yr**	5.23	6.67	7.46	8.82	9.97	**200yr**
500yr	0.54	0.80	1.03	1.49	2.13	2.65	**500yr**	1.83	2.59	3.47	4.42	5.52	6.98	8.26	**500yr**	6.18	7.95	8.79	10.39	11.73	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.88	1.04	**1yr**	0.76	1.01	1.17	1.52	1.92	2.44	2.78	**1yr**	2.16	2.67	3.09	3.74	4.31	**1yr**
2yr	0.33	0.51	0.62	0.85	1.04	1.21	**2yr**	0.90	1.19	1.37	1.79	2.30	2.76	3.07	**2yr**	2.44	2.95	3.42	4.07	4.68	**2yr**
5yr	0.41	0.62	0.78	1.06	1.35	1.62	**5yr**	1.17	1.59	1.82	2.27	2.87	3.45	3.98	**5yr**	3.06	3.83	4.39	5.18	5.89	**5yr**
10yr	0.49	0.75	0.94	1.31	1.69	2.05	**10yr**	1.46	2.00	2.26	2.69	3.38	4.16	4.87	**10yr**	3.68	4.68	5.32	6.24	7.03	**10yr**
25yr	0.63	0.97	1.20	1.71	2.26	2.81	**25yr**	1.95	2.75	3.04	3.45	4.29	5.32	6.38	**25yr**	4.71	6.13	6.88	7.96	8.89	**25yr**
50yr	0.77	1.17	1.45	2.09	2.81	3.58	**50yr**	2.42	3.50	3.80	4.15	5.15	6.41	7.83	**50yr**	5.67	7.53	8.37	9.60	10.61	**50yr**
100yr	0.94	1.42	1.78	2.57	3.52	4.59	**100yr**	3.04	4.49	4.75	5.43	6.17	7.74	9.59	**100yr**	6.85	9.23	10.19	11.59	12.67	**100yr**
200yr	1.14	1.72	2.18	3.15	4.40	5.90	**200yr**	3.80	5.77	5.96	6.61	8.70	9.35	11.76	**200yr**	8.28	11.31	12.41	13.99	15.14	**200yr**
500yr	1.49	2.22	2.86	4.15	5.91	8.25	**500yr**	5.10	8.07	8.04	8.58	11.40	11.99	15.44	**500yr**	10.61	14.85	16.13	17.98	19.16	**500yr**

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Northeast Regional Climate Center

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.851 degrees West
Latitude	43.604 degrees North
Elevation	1,872 feet
Date/Time	Mon, 30 Sep 2013 13:50:10 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.39	0.49	0.64	0.80	1.01	**1yr**	0.69	0.94	1.16	1.45	1.80	2.24	2.53	**1yr**	1.99	2.44	2.82	3.48	4.03	**1yr**
2yr	0.31	0.47	0.59	0.78	0.98	1.23	**2yr**	0.85	1.12	1.41	1.74	2.14	2.63	2.97	**2yr**	2.33	2.86	3.31	3.97	4.57	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.55	**5yr**	1.06	1.43	1.78	2.19	2.68	3.25	3.71	**5yr**	2.87	3.57	4.10	4.87	5.56	**5yr**
10yr	0.42	0.66	0.83	1.13	1.46	1.86	**10yr**	1.26	1.72	2.14	2.62	3.17	3.81	4.39	**10yr**	3.37	4.22	4.83	5.69	6.46	**10yr**
25yr	0.50	0.79	1.01	1.39	1.84	2.35	**25yr**	1.59	2.20	2.70	3.30	3.97	4.71	5.49	**25yr**	4.17	5.28	5.99	6.99	7.86	**25yr**
50yr	0.57	0.91	1.17	1.64	2.19	2.81	**50yr**	1.89	2.65	3.24	3.94	4.70	5.54	6.51	**50yr**	4.90	6.26	7.05	8.17	9.13	**50yr**
100yr	0.65	1.05	1.35	1.92	2.62	3.36	**100yr**	2.26	3.20	3.88	4.70	5.58	6.51	7.72	**100yr**	5.76	7.42	8.31	9.57	10.61	**100yr**
200yr	0.75	1.22	1.58	2.26	3.12	4.02	**200yr**	2.69	3.87	4.63	5.59	6.60	7.66	9.15	**200yr**	6.78	8.80	9.80	11.20	12.33	**200yr**
500yr	0.91	1.49	1.94	2.81	3.94	5.09	**500yr**	3.40	4.98	5.86	7.05	8.26	9.49	11.47	**500yr**	8.40	11.03	12.20	13.80	15.04	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.36	0.44	0.60	0.73	0.89	**1yr**	0.63	0.87	1.02	1.29	1.64	2.06	2.16	**1yr**	1.82	2.08	2.52	2.99	3.34	**1yr**
2yr	0.30	0.46	0.57	0.77	0.95	1.11	**2yr**	0.82	1.09	1.27	1.68	2.15	2.54	2.90	**2yr**	2.25	2.79	3.24	3.88	4.48	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.33	**5yr**	0.97	1.30	1.51	1.96	2.50	3.05	3.46	**5yr**	2.70	3.33	3.83	4.58	5.24	**5yr**
10yr	0.37	0.56	0.70	0.97	1.26	1.50	**10yr**	1.09	1.47	1.71	2.19	2.80	3.46	3.94	**10yr**	3.06	3.79	4.35	5.18	5.93	**10yr**
25yr	0.40	0.62	0.77	1.09	1.44	1.75	**25yr**	1.24	1.71	2.02	2.55	3.28	4.08	4.69	**25yr**	3.61	4.51	5.13	6.11	6.94	**25yr**
50yr	0.43	0.66	0.82	1.17	1.58	1.95	**50yr**	1.36	1.91	2.29	2.85	3.67	4.63	5.35	**50yr**	4.10	5.14	5.82	6.91	7.84	**50yr**
100yr	0.46	0.70	0.88	1.27	1.74	2.17	**100yr**	1.50	2.12	2.60	3.32	4.14	5.23	6.10	**100yr**	4.63	5.86	6.61	7.83	8.85	**100yr**
200yr	0.49	0.74	0.94	1.37	1.90	2.39	**200yr**	1.64	2.34	2.94	3.76	4.76	5.94	6.96	**200yr**	5.25	6.69	7.50	8.87	10.00	**200yr**
500yr	0.54	0.81	1.04	1.51	2.14	2.67	**500yr**	1.85	2.61	3.47	4.42	5.55	7.02	8.30	**500yr**	6.22	7.98	8.85	10.46	11.77	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.88	1.03	**1yr**	0.76	1.01	1.17	1.52	1.91	2.43	2.77	**1yr**	2.15	2.66	3.08	3.74	4.31	**1yr**
2yr	0.33	0.51	0.62	0.84	1.04	1.21	**2yr**	0.90	1.19	1.37	1.79	2.30	2.76	3.07	**2yr**	2.44	2.95	3.42	4.07	4.68	**2yr**
5yr	0.41	0.62	0.78	1.06	1.35	1.63	**5yr**	1.17	1.59	1.82	2.27	2.87	3.45	3.98	**5yr**	3.06	3.83	4.38	5.18	5.90	**5yr**
10yr	0.49	0.75	0.94	1.31	1.69	2.05	**10yr**	1.46	2.01	2.27	2.69	3.38	4.16	4.87	**10yr**	3.68	4.68	5.31	6.23	7.03	**10yr**
25yr	0.64	0.97	1.20	1.72	2.26	2.82	**25yr**	1.95	2.76	3.04	3.44	4.29	5.32	6.36	**25yr**	4.70	6.12	6.86	7.94	8.89	**25yr**
50yr	0.77	1.17	1.45	2.09	2.81	3.60	**50yr**	2.43	3.52	3.81	4.14	5.14	6.40	7.80	**50yr**	5.67	7.50	8.33	9.57	10.61	**50yr**
100yr	0.94	1.42	1.78	2.57	3.52	4.62	**100yr**	3.04	4.52	4.77	5.43	6.16	7.72	9.56	**100yr**	6.84	9.19	10.13	11.54	12.66	**100yr**
200yr	1.14	1.72	2.18	3.16	4.41	5.94	**200yr**	3.80	5.81	5.98	6.61	8.72	9.33	11.71	**200yr**	8.26	11.26	12.32	13.92	15.12	**200yr**
500yr	1.50	2.23	2.86	4.16	5.92	8.32	**500yr**	5.11	8.14	8.07	8.58	11.44	11.95	15.35	**500yr**	10.58	14.76	15.99	17.87	19.12	**500yr**

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Northeast Regional Climate Center

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.852 degrees West
Latitude	43.588 degrees North
Elevation	2,126 feet
Date/Time	Mon, 30 Sep 2013 13:52:19 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.39	0.49	0.64	0.80	1.01	**1yr**	0.69	0.94	1.16	1.45	1.80	2.25	2.54	**1yr**	1.99	2.44	2.82	3.48	4.03	**1yr**
2yr	0.31	0.47	0.59	0.78	0.98	1.23	**2yr**	0.85	1.12	1.41	1.74	2.14	2.63	2.97	**2yr**	2.33	2.86	3.31	3.97	4.57	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.55	**5yr**	1.06	1.43	1.79	2.20	2.68	3.25	3.71	**5yr**	2.88	3.57	4.11	4.87	5.57	**5yr**
10yr	0.42	0.66	0.83	1.13	1.47	1.86	**10yr**	1.26	1.72	2.14	2.62	3.18	3.82	4.40	**10yr**	3.38	4.23	4.84	5.70	6.46	**10yr**
25yr	0.50	0.79	1.01	1.39	1.84	2.35	**25yr**	1.59	2.20	2.70	3.30	3.98	4.72	5.50	**25yr**	4.18	5.29	6.01	7.01	7.87	**25yr**
50yr	0.57	0.91	1.17	1.64	2.19	2.81	**50yr**	1.89	2.66	3.24	3.94	4.71	5.55	6.52	**50yr**	4.91	6.27	7.09	8.20	9.15	**50yr**
100yr	0.65	1.05	1.35	1.92	2.62	3.36	**100yr**	2.26	3.21	3.88	4.70	5.58	6.52	7.73	**100yr**	5.77	7.44	8.36	9.60	10.63	**100yr**
200yr	0.75	1.22	1.58	2.26	3.12	4.01	**200yr**	2.69	3.88	4.63	5.60	6.61	7.67	9.17	**200yr**	6.79	8.82	9.86	11.24	12.36	**200yr**
500yr	0.90	1.49	1.94	2.81	3.93	5.08	**500yr**	3.39	4.99	5.86	7.05	8.27	9.52	11.50	**500yr**	8.42	11.06	12.29	13.86	15.08	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.44	0.59	0.72	0.88	**1yr**	0.62	0.86	1.01	1.29	1.64	2.04	2.17	**1yr**	1.80	2.09	2.53	2.94	3.30	**1yr**
2yr	0.30	0.46	0.57	0.77	0.95	1.12	**2yr**	0.82	1.09	1.27	1.68	2.16	2.54	2.88	**2yr**	2.25	2.77	3.23	3.87	4.46	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.33	**5yr**	0.98	1.30	1.52	1.96	2.51	3.03	3.42	**5yr**	2.68	3.29	3.79	4.55	5.22	**5yr**
10yr	0.37	0.56	0.70	0.98	1.26	1.50	**10yr**	1.09	1.47	1.72	2.19	2.81	3.42	3.88	**10yr**	3.03	3.73	4.29	5.13	5.88	**10yr**
25yr	0.40	0.62	0.77	1.09	1.44	1.75	**25yr**	1.24	1.71	2.03	2.55	3.28	4.01	4.59	**25yr**	3.55	4.42	5.04	6.03	6.88	**25yr**
50yr	0.43	0.65	0.81	1.17	1.57	1.94	**50yr**	1.36	1.90	2.30	2.85	3.67	4.53	5.21	**50yr**	4.01	5.01	5.69	6.81	7.76	**50yr**
100yr	0.46	0.69	0.87	1.25	1.72	2.15	**100yr**	1.49	2.10	2.61	3.33	4.14	5.10	5.91	**100yr**	4.51	5.68	6.43	7.68	8.74	**100yr**
200yr	0.49	0.73	0.93	1.34	1.87	2.36	**200yr**	1.62	2.31	2.95	3.77	4.74	5.76	6.70	**200yr**	5.10	6.44	7.26	8.69	9.86	**200yr**
500yr	0.53	0.79	1.01	1.47	2.09	2.63	**500yr**	1.81	2.57	3.48	4.43	5.51	6.77	7.92	**500yr**	5.99	7.61	8.52	10.21	11.59	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.44	0.53	0.71	0.88	1.04	**1yr**	0.76	1.02	1.17	1.52	1.92	2.47	2.81	**1yr**	2.19	2.71	3.11	3.77	4.33	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.22	**2yr**	0.90	1.19	1.38	1.79	2.30	2.76	3.09	**2yr**	2.44	2.97	3.44	4.09	4.70	**2yr**
5yr	0.41	0.62	0.78	1.06	1.35	1.63	**5yr**	1.17	1.59	1.82	2.27	2.87	3.48	4.03	**5yr**	3.08	3.87	4.43	5.22	5.93	**5yr**
10yr	0.49	0.75	0.94	1.31	1.69	2.05	**10yr**	1.46	2.00	2.27	2.69	3.39	4.20	4.94	**10yr**	3.72	4.75	5.39	6.29	7.09	**10yr**
25yr	0.63	0.96	1.20	1.71	2.25	2.81	**25yr**	1.95	2.75	3.04	3.45	4.30	5.38	6.50	**25yr**	4.76	6.25	7.00	8.04	8.97	**25yr**
50yr	0.77	1.17	1.45	2.09	2.81	3.59	**50yr**	2.42	3.51	3.80	4.16	5.16	6.49	8.00	**50yr**	5.74	7.70	8.54	9.71	10.72	**50yr**
100yr	0.94	1.42	1.78	2.57	3.52	4.60	**100yr**	3.04	4.49	4.76	5.45	6.19	7.85	9.85	**100yr**	6.95	9.47	10.43	11.73	12.81	**100yr**
200yr	1.14	1.72	2.18	3.15	4.40	5.91	**200yr**	3.80	5.77	5.96	6.64	8.76	9.50	12.13	**200yr**	8.41	11.66	12.74	14.18	15.32	**200yr**
500yr	1.49	2.22	2.86	4.15	5.91	8.26	**500yr**	5.10	8.07	8.03	8.63	11.49	12.22	16.00	**500yr**	10.82	15.39	16.61	18.24	19.40	**500yr**

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Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.833 degrees West
Latitude	43.577 degrees North
Elevation	2,001 feet
Date/Time	Mon, 30 Sep 2013 13:55:02 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.39	0.49	0.64	0.80	1.01	**1yr**	0.69	0.94	1.16	1.45	1.81	2.25	2.54	**1yr**	2.00	2.45	2.83	3.49	4.04	**1yr**
2yr	0.31	0.47	0.59	0.78	0.98	1.23	**2yr**	0.85	1.12	1.41	1.75	2.15	2.64	2.98	**2yr**	2.34	2.87	3.32	3.98	4.59	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.55	**5yr**	1.06	1.43	1.79	2.20	2.69	3.26	3.73	**5yr**	2.89	3.59	4.12	4.89	5.59	**5yr**
10yr	0.42	0.66	0.83	1.13	1.47	1.86	**10yr**	1.27	1.73	2.14	2.63	3.19	3.83	4.42	**10yr**	3.39	4.25	4.86	5.71	6.49	**10yr**
25yr	0.50	0.79	1.01	1.39	1.85	2.35	**25yr**	1.59	2.21	2.71	3.31	3.99	4.74	5.53	**25yr**	4.20	5.32	6.04	7.03	7.91	**25yr**
50yr	0.57	0.91	1.17	1.64	2.20	2.81	**50yr**	1.90	2.67	3.24	3.95	4.72	5.57	6.56	**50yr**	4.93	6.31	7.12	8.22	9.19	**50yr**
100yr	0.65	1.05	1.36	1.92	2.62	3.37	**100yr**	2.26	3.23	3.88	4.71	5.60	6.55	7.79	**100yr**	5.80	7.49	8.40	9.63	10.68	**100yr**
200yr	0.74	1.21	1.57	2.26	3.12	4.03	**200yr**	2.69	3.91	4.65	5.62	6.64	7.71	9.24	**200yr**	6.82	8.88	9.92	11.28	12.42	**200yr**
500yr	0.91	1.49	1.94	2.81	3.94	5.09	**500yr**	3.40	5.03	5.87	7.07	8.30	9.56	11.59	**500yr**	8.46	11.15	12.36	13.91	15.17	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.44	0.59	0.72	0.88	**1yr**	0.62	0.86	1.01	1.29	1.64	2.00	2.21	**1yr**	1.77	2.12	2.51	2.86	3.28	**1yr**
2yr	0.30	0.46	0.57	0.77	0.95	1.12	**2yr**	0.82	1.09	1.27	1.68	2.17	2.56	2.87	**2yr**	2.27	2.76	3.21	3.86	4.45	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.33	**5yr**	0.98	1.30	1.52	1.96	2.52	2.99	3.38	**5yr**	2.65	3.25	3.75	4.50	5.18	**5yr**
10yr	0.37	0.56	0.70	0.97	1.26	1.50	**10yr**	1.09	1.47	1.72	2.19	2.82	3.37	3.79	**10yr**	2.98	3.65	4.22	5.06	5.83	**10yr**
25yr	0.40	0.61	0.76	1.09	1.43	1.75	**25yr**	1.23	1.71	2.03	2.55	3.30	3.91	4.44	**25yr**	3.46	4.27	4.91	5.93	6.80	**25yr**
50yr	0.43	0.65	0.81	1.16	1.56	1.94	**50yr**	1.35	1.90	2.31	2.84	3.70	4.40	4.99	**50yr**	3.89	4.80	5.51	6.67	7.65	**50yr**
100yr	0.45	0.69	0.86	1.24	1.70	2.15	**100yr**	1.47	2.10	2.62	3.35	4.17	4.91	5.60	**100yr**	4.35	5.39	6.19	7.51	8.59	**100yr**
200yr	0.48	0.72	0.91	1.32	1.84	2.35	**200yr**	1.59	2.30	2.97	3.79	4.75	5.51	6.29	**200yr**	4.88	6.05	6.95	8.47	9.69	**200yr**
500yr	0.52	0.77	0.99	1.44	2.04	2.61	**500yr**	1.76	2.55	3.51	4.47	5.53	6.42	7.32	**500yr**	5.68	7.04	8.09	9.94	11.36	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.44	0.53	0.71	0.88	1.04	**1yr**	0.76	1.02	1.17	1.52	1.92	2.52	2.88	**1yr**	2.23	2.77	3.15	3.81	4.38	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.22	**2yr**	0.91	1.19	1.38	1.79	2.31	2.76	3.12	**2yr**	2.44	3.00	3.48	4.14	4.75	**2yr**
5yr	0.41	0.63	0.78	1.06	1.35	1.63	**5yr**	1.17	1.59	1.83	2.28	2.88	3.53	4.11	**5yr**	3.13	3.95	4.51	5.29	6.00	**5yr**
10yr	0.49	0.76	0.94	1.31	1.69	2.06	**10yr**	1.46	2.01	2.28	2.70	3.39	4.27	5.07	**10yr**	3.78	4.87	5.51	6.37	7.18	**10yr**
25yr	0.64	0.97	1.20	1.72	2.26	2.83	**25yr**	1.95	2.76	3.05	3.46	4.31	5.47	6.72	**25yr**	4.84	6.46	7.20	8.17	9.11	**25yr**
50yr	0.77	1.17	1.45	2.09	2.81	3.61	**50yr**	2.43	3.53	3.82	4.17	5.18	6.63	8.31	**50yr**	5.87	7.99	8.82	9.88	10.90	**50yr**
100yr	0.94	1.42	1.78	2.57	3.53	4.63	**100yr**	3.04	4.52	4.78	5.50	6.21	8.04	10.29	**100yr**	7.12	9.90	10.82	11.95	13.05	**100yr**
200yr	1.15	1.72	2.18	3.16	4.41	5.95	**200yr**	3.81	5.82	5.99	6.71	8.89	9.77	12.75	**200yr**	8.64	12.26	13.26	14.45	15.63	**200yr**
500yr	1.50	2.23	2.87	4.17	5.93	8.34	**500yr**	5.11	8.15	8.07	8.73	11.69	12.62	16.96	**500yr**	11.17	16.31	17.38	18.61	19.81	**500yr**

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Northeast Regional Climate Center

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.832 degrees West
Latitude	43.586 degrees North
Elevation	2,114 feet
Date/Time	Mon, 30 Sep 2013 13:56:22 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.39	0.49	0.64	0.80	1.01	**1yr**	0.69	0.94	1.16	1.45	1.80	2.25	2.54	**1yr**	1.99	2.44	2.83	3.49	4.04	**1yr**
2yr	0.31	0.47	0.59	0.78	0.98	1.23	**2yr**	0.85	1.12	1.41	1.74	2.15	2.64	2.98	**2yr**	2.34	2.87	3.32	3.98	4.59	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.55	**5yr**	1.06	1.43	1.79	2.20	2.69	3.26	3.73	**5yr**	2.89	3.59	4.12	4.89	5.58	**5yr**
10yr	0.42	0.66	0.83	1.13	1.47	1.86	**10yr**	1.27	1.73	2.14	2.63	3.19	3.83	4.42	**10yr**	3.39	4.25	4.85	5.71	6.48	**10yr**
25yr	0.50	0.79	1.01	1.39	1.84	2.35	**25yr**	1.59	2.21	2.71	3.31	3.98	4.74	5.53	**25yr**	4.19	5.32	6.03	7.02	7.90	**25yr**
50yr	0.57	0.91	1.17	1.64	2.20	2.81	**50yr**	1.90	2.67	3.24	3.95	4.72	5.57	6.56	**50yr**	4.93	6.30	7.10	8.21	9.18	**50yr**
100yr	0.65	1.05	1.36	1.92	2.62	3.37	**100yr**	2.26	3.23	3.88	4.71	5.59	6.54	7.78	**100yr**	5.79	7.48	8.38	9.61	10.67	**100yr**
200yr	0.74	1.21	1.57	2.26	3.12	4.03	**200yr**	2.69	3.91	4.65	5.62	6.63	7.70	9.23	**200yr**	6.81	8.87	9.89	11.26	12.40	**200yr**
500yr	0.91	1.49	1.94	2.82	3.94	5.09	**500yr**	3.40	5.03	5.87	7.06	8.29	9.54	11.58	**500yr**	8.45	11.13	12.32	13.88	15.15	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.44	0.59	0.72	0.89	**1yr**	0.63	0.87	1.01	1.30	1.64	2.01	2.20	**1yr**	1.78	2.11	2.50	2.88	3.30	**1yr**
2yr	0.30	0.46	0.57	0.77	0.95	1.12	**2yr**	0.82	1.09	1.27	1.68	2.16	2.56	2.87	**2yr**	2.27	2.76	3.21	3.86	4.45	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.33	**5yr**	0.98	1.30	1.52	1.96	2.51	3.00	3.39	**5yr**	2.66	3.26	3.76	4.51	5.19	**5yr**
10yr	0.37	0.56	0.70	0.97	1.26	1.50	**10yr**	1.09	1.47	1.72	2.19	2.82	3.38	3.81	**10yr**	2.99	3.67	4.23	5.08	5.84	**10yr**
25yr	0.40	0.61	0.76	1.09	1.43	1.75	**25yr**	1.23	1.71	2.03	2.55	3.30	3.94	4.47	**25yr**	3.48	4.30	4.94	5.96	6.82	**25yr**
50yr	0.43	0.65	0.81	1.16	1.56	1.95	**50yr**	1.35	1.90	2.30	2.84	3.70	4.43	5.03	**50yr**	3.92	4.84	5.55	6.71	7.68	**50yr**
100yr	0.46	0.69	0.86	1.25	1.71	2.16	**100yr**	1.48	2.11	2.62	3.34	4.18	4.96	5.66	**100yr**	4.39	5.44	6.25	7.56	8.63	**100yr**
200yr	0.48	0.73	0.92	1.33	1.86	2.37	**200yr**	1.60	2.32	2.97	3.79	4.76	5.58	6.37	**200yr**	4.93	6.13	7.03	8.54	9.73	**200yr**
500yr	0.52	0.78	1.00	1.46	2.07	2.63	**500yr**	1.79	2.57	3.51	4.46	5.55	6.51	7.44	**500yr**	5.76	7.15	8.20	10.03	11.42	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.88	1.04	**1yr**	0.76	1.01	1.17	1.52	1.92	2.51	2.87	**1yr**	2.22	2.76	3.14	3.80	4.37	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.22	**2yr**	0.90	1.19	1.38	1.79	2.31	2.76	3.12	**2yr**	2.44	3.00	3.47	4.13	4.74	**2yr**
5yr	0.41	0.63	0.78	1.06	1.35	1.63	**5yr**	1.17	1.59	1.82	2.28	2.88	3.52	4.09	**5yr**	3.12	3.93	4.49	5.27	5.99	**5yr**
10yr	0.49	0.76	0.94	1.31	1.69	2.06	**10yr**	1.46	2.01	2.28	2.69	3.39	4.25	5.04	**10yr**	3.76	4.85	5.48	6.35	7.17	**10yr**
25yr	0.64	0.97	1.20	1.72	2.26	2.83	**25yr**	1.95	2.77	3.05	3.45	4.31	5.45	6.66	**25yr**	4.82	6.41	7.14	8.13	9.08	**25yr**
50yr	0.77	1.17	1.46	2.09	2.82	3.62	**50yr**	2.43	3.53	3.82	4.16	5.17	6.59	8.23	**50yr**	5.83	7.92	8.74	9.82	10.86	**50yr**
100yr	0.94	1.42	1.78	2.57	3.53	4.64	**100yr**	3.05	4.54	4.79	5.49	6.19	7.99	10.18	**100yr**	7.07	9.79	10.70	11.87	13.00	**100yr**
200yr	1.15	1.73	2.19	3.17	4.41	5.97	**200yr**	3.81	5.84	6.00	6.69	8.87	9.69	12.58	**200yr**	8.57	12.10	13.09	14.34	15.55	**200yr**
500yr	1.50	2.23	2.87	4.17	5.93	8.37	**500yr**	5.12	8.18	8.09	8.71	11.66	12.49	16.70	**500yr**	11.06	16.06	17.12	18.45	19.70	**500yr**

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Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.822 degrees West
Latitude	43.593 degrees North
Elevation	1,651 feet
Date/Time	Mon, 30 Sep 2013 13:57:37 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.39	0.49	0.64	0.80	1.01	**1yr**	0.69	0.94	1.16	1.45	1.80	2.25	2.54	**1yr**	1.99	2.44	2.83	3.49	4.04	**1yr**
2yr	0.31	0.47	0.59	0.78	0.98	1.23	**2yr**	0.85	1.12	1.41	1.74	2.15	2.64	2.98	**2yr**	2.34	2.87	3.32	3.98	4.59	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.55	**5yr**	1.06	1.43	1.78	2.20	2.69	3.26	3.73	**5yr**	2.89	3.59	4.12	4.89	5.59	**5yr**
10yr	0.42	0.66	0.83	1.13	1.47	1.86	**10yr**	1.26	1.73	2.14	2.63	3.19	3.83	4.42	**10yr**	3.39	4.25	4.85	5.71	6.48	**10yr**
25yr	0.50	0.79	1.01	1.39	1.84	2.35	**25yr**	1.59	2.21	2.71	3.31	3.99	4.74	5.53	**25yr**	4.19	5.32	6.02	7.02	7.90	**25yr**
50yr	0.57	0.91	1.17	1.64	2.20	2.81	**50yr**	1.90	2.67	3.24	3.95	4.72	5.57	6.56	**50yr**	4.93	6.31	7.09	8.21	9.18	**50yr**
100yr	0.65	1.05	1.36	1.92	2.62	3.37	**100yr**	2.26	3.23	3.88	4.71	5.59	6.54	7.78	**100yr**	5.79	7.48	8.36	9.61	10.67	**100yr**
200yr	0.75	1.22	1.58	2.27	3.12	4.02	**200yr**	2.69	3.91	4.64	5.61	6.62	7.69	9.23	**200yr**	6.81	8.88	9.87	11.25	12.40	**200yr**
500yr	0.91	1.49	1.94	2.82	3.94	5.09	**500yr**	3.40	5.04	5.87	7.06	8.29	9.54	11.58	**500yr**	8.44	11.14	12.28	13.86	15.14	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.44	0.59	0.73	0.89	**1yr**	0.63	0.87	1.02	1.30	1.64	2.01	2.19	**1yr**	1.78	2.11	2.49	2.88	3.32	**1yr**
2yr	0.30	0.46	0.57	0.77	0.95	1.12	**2yr**	0.82	1.09	1.27	1.68	2.16	2.56	2.88	**2yr**	2.27	2.77	3.21	3.86	4.45	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.33	**5yr**	0.97	1.30	1.52	1.96	2.51	3.01	3.39	**5yr**	2.66	3.26	3.76	4.52	5.20	**5yr**
10yr	0.36	0.56	0.70	0.97	1.25	1.50	**10yr**	1.08	1.47	1.72	2.19	2.82	3.39	3.82	**10yr**	3.00	3.67	4.24	5.09	5.85	**10yr**
25yr	0.40	0.61	0.76	1.09	1.43	1.75	**25yr**	1.23	1.71	2.03	2.55	3.30	3.95	4.48	**25yr**	3.49	4.31	4.95	5.97	6.83	**25yr**
50yr	0.43	0.65	0.81	1.16	1.56	1.95	**50yr**	1.35	1.91	2.30	2.84	3.71	4.45	5.04	**50yr**	3.94	4.85	5.57	6.73	7.69	**50yr**
100yr	0.46	0.69	0.87	1.25	1.71	2.17	**100yr**	1.48	2.12	2.62	3.34	4.18	4.98	5.67	**100yr**	4.41	5.46	6.28	7.60	8.65	**100yr**
200yr	0.49	0.73	0.93	1.34	1.87	2.38	**200yr**	1.61	2.33	2.97	3.79	4.79	5.60	6.39	**200yr**	4.96	6.15	7.07	8.58	9.76	**200yr**
500yr	0.53	0.79	1.01	1.47	2.09	2.65	**500yr**	1.80	2.60	3.51	4.46	5.58	6.55	7.47	**500yr**	5.80	7.18	8.27	10.09	11.46	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.87	1.04	**1yr**	0.75	1.01	1.17	1.52	1.91	2.50	2.86	**1yr**	2.22	2.75	3.13	3.79	4.36	**1yr**
2yr	0.33	0.51	0.62	0.85	1.04	1.22	**2yr**	0.90	1.19	1.37	1.79	2.31	2.76	3.12	**2yr**	2.44	3.00	3.47	4.13	4.75	**2yr**
5yr	0.41	0.63	0.78	1.06	1.35	1.63	**5yr**	1.17	1.60	1.82	2.28	2.88	3.52	4.09	**5yr**	3.12	3.93	4.49	5.27	5.99	**5yr**
10yr	0.49	0.76	0.94	1.31	1.69	2.06	**10yr**	1.46	2.01	2.28	2.69	3.39	4.25	5.03	**10yr**	3.76	4.84	5.46	6.35	7.17	**10yr**
25yr	0.64	0.97	1.20	1.72	2.26	2.84	**25yr**	1.95	2.78	3.06	3.45	4.30	5.44	6.65	**25yr**	4.82	6.39	7.12	8.12	9.08	**25yr**
50yr	0.77	1.17	1.46	2.09	2.82	3.63	**50yr**	2.43	3.55	3.83	4.16	5.16	6.58	8.20	**50yr**	5.82	7.89	8.70	9.79	10.85	**50yr**
100yr	0.94	1.42	1.78	2.58	3.53	4.67	**100yr**	3.05	4.56	4.80	5.49	6.18	7.97	10.13	**100yr**	7.05	9.74	10.64	11.82	12.98	**100yr**
200yr	1.15	1.73	2.19	3.17	4.42	6.01	**200yr**	3.82	5.88	6.02	6.70	8.90	9.66	12.52	**200yr**	8.55	12.04	13.00	14.27	15.53	**200yr**
500yr	1.50	2.23	2.88	4.18	5.94	8.44	**500yr**	5.13	8.25	8.13	8.71	11.70	12.45	16.60	**500yr**	11.01	15.96	16.97	18.34	19.66	**500yr**

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Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	71.796 degrees West
Latitude	43.581 degrees North
Elevation	637 feet
Date/Time	Mon, 30 Sep 2013 13:59:15 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.39	0.49	0.64	0.80	1.01	**1yr**	0.69	0.94	1.16	1.45	1.81	2.26	2.55	**1yr**	2.00	2.45	2.84	3.50	4.05	**1yr**
2yr	0.31	0.48	0.59	0.78	0.98	1.23	**2yr**	0.85	1.12	1.41	1.75	2.16	2.65	3.00	**2yr**	2.35	2.88	3.34	4.00	4.60	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.55	**5yr**	1.06	1.44	1.79	2.21	2.70	3.28	3.75	**5yr**	2.90	3.61	4.14	4.91	5.61	**5yr**
10yr	0.42	0.66	0.83	1.13	1.47	1.86	**10yr**	1.27	1.73	2.15	2.64	3.20	3.85	4.44	**10yr**	3.41	4.27	4.88	5.74	6.51	**10yr**
25yr	0.50	0.79	1.01	1.39	1.85	2.35	**25yr**	1.59	2.22	2.71	3.32	4.00	4.76	5.57	**25yr**	4.21	5.36	6.06	7.05	7.94	**25yr**
50yr	0.57	0.91	1.17	1.64	2.20	2.82	**50yr**	1.90	2.69	3.25	3.96	4.74	5.59	6.61	**50yr**	4.95	6.35	7.15	8.25	9.23	**50yr**
100yr	0.65	1.05	1.36	1.92	2.62	3.37	**100yr**	2.26	3.25	3.89	4.73	5.62	6.58	7.84	**100yr**	5.82	7.54	8.44	9.66	10.74	**100yr**
200yr	0.74	1.21	1.57	2.26	3.12	4.03	**200yr**	2.70	3.94	4.66	5.63	6.66	7.74	9.31	**200yr**	6.85	8.95	9.96	11.31	12.48	**200yr**
500yr	0.91	1.49	1.94	2.82	3.94	5.10	**500yr**	3.40	5.08	5.88	7.09	8.32	9.59	11.69	**500yr**	8.49	11.24	12.42	13.95	15.25	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.44	0.59	0.72	0.89	**1yr**	0.62	0.87	1.01	1.30	1.64	1.99	2.23	**1yr**	1.76	2.15	2.51	2.93	3.32	**1yr**
2yr	0.30	0.47	0.57	0.78	0.96	1.12	**2yr**	0.83	1.09	1.27	1.68	2.17	2.58	2.89	**2yr**	2.28	2.78	3.23	3.88	4.47	**2yr**
5yr	0.34	0.52	0.65	0.89	1.13	1.33	**5yr**	0.98	1.30	1.52	1.96	2.52	3.01	3.41	**5yr**	2.67	3.28	3.78	4.54	5.22	**5yr**
10yr	0.36	0.56	0.70	0.97	1.25	1.50	**10yr**	1.08	1.47	1.72	2.19	2.83	3.39	3.83	**10yr**	3.00	3.69	4.26	5.11	5.87	**10yr**
25yr	0.40	0.61	0.76	1.08	1.42	1.75	**25yr**	1.23	1.71	2.04	2.55	3.32	3.94	4.50	**25yr**	3.49	4.32	4.97	6.00	6.85	**25yr**
50yr	0.42	0.64	0.80	1.15	1.55	1.95	**50yr**	1.34	1.90	2.32	2.84	3.73	4.43	5.06	**50yr**	3.92	4.86	5.58	6.76	7.72	**50yr**
100yr	0.45	0.68	0.85	1.23	1.69	2.15	**100yr**	1.45	2.10	2.64	3.37	4.22	4.94	5.68	**100yr**	4.38	5.47	6.28	7.63	8.68	**100yr**
200yr	0.47	0.71	0.90	1.31	1.82	2.36	**200yr**	1.57	2.31	3.00	3.83	4.79	5.54	6.39	**200yr**	4.90	6.15	7.06	8.62	9.79	**200yr**
500yr	0.51	0.76	0.97	1.41	2.01	2.61	**500yr**	1.74	2.55	3.56	4.52	5.57	6.44	7.45	**500yr**	5.70	7.16	8.23	10.14	11.48	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.88	1.04	**1yr**	0.76	1.01	1.17	1.52	1.91	2.51	2.84	**1yr**	2.22	2.73	3.13	3.80	4.37	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.22	**2yr**	0.91	1.19	1.38	1.80	2.32	2.77	3.13	**2yr**	2.45	3.01	3.48	4.15	4.76	**2yr**
5yr	0.41	0.63	0.78	1.07	1.36	1.64	**5yr**	1.17	1.60	1.83	2.29	2.89	3.55	4.11	**5yr**	3.14	3.96	4.51	5.30	6.01	**5yr**
10yr	0.49	0.76	0.94	1.31	1.69	2.07	**10yr**	1.46	2.02	2.29	2.70	3.40	4.30	5.07	**10yr**	3.80	4.88	5.51	6.38	7.20	**10yr**
25yr	0.64	0.97	1.21	1.72	2.26	2.85	**25yr**	1.95	2.79	3.08	3.46	4.32	5.52	6.72	**25yr**	4.89	6.46	7.20	8.17	9.12	**25yr**
50yr	0.77	1.17	1.46	2.10	2.82	3.64	**50yr**	2.44	3.56	3.85	4.18	5.18	6.71	8.31	**50yr**	5.94	7.99	8.81	9.88	10.92	**50yr**
100yr	0.94	1.43	1.79	2.58	3.54	4.68	**100yr**	3.05	4.58	4.82	5.56	6.21	8.15	10.30	**100yr**	7.21	9.90	10.81	11.93	13.07	**100yr**
200yr	1.15	1.73	2.19	3.18	4.43	6.04	**200yr**	3.82	5.91	6.05	6.79	9.04	9.91	12.76	**200yr**	8.78	12.27	13.24	14.41	15.65	**200yr**
500yr	1.50	2.24	2.88	4.18	5.95	8.48	**500yr**	5.14	8.29	8.16	8.84	11.92	12.85	16.97	**500yr**	11.37	16.32	17.36	18.54	19.84	**500yr**

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SECTION 3.0 - DRAINAGE CALCULATIONS, ANALYSIS & DESIGN

3.1 Groundwater Recharge Volume (GRV) Calculations

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building

A. Overall Project

Groundwater Recharge Volume (GRV) Calculation

0.33	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
0.57	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
15.04	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
10.33	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.07	inches	Rd = weighted groundwater recharge depth	
1.77723	ac-in	GRV = AI * Rd	
6,451	cf	GRV conversion (ac-in x 43,560 sf/ac x 1ft/12”)	

Provide calculations below showing that the project meets the groundwater recharge requirements (Env-Wq 1507.04):

WIND FARM ROADS AND TURBINE PADS.

EXCLUDES OPERATIONS AND MAINTENANCE FACILITY

EXCLUDES SUBSTATION AND INTERCONNECTION STATION

B. Substation Interconnection Station

Groundwater Recharge Volume (GRV) Calculation

0.05	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
0.56	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
0.36	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
1.0525	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.10	inches	Rd = weighted groundwater recharge depth	
0.19582	ac-in	GRV = AI * Rd	
711	cf	GRV conversion (ac-in x 43,560 sf/ac x 1ft/12")	

Provide calculations below showing that the project meets the groundwater recharge requirements (Env-Wq 1507.04):

Substation Calculations

C. Operation and Maintenance Building

Groundwater Recharge Volume (GRV) Calculation

	ac	Area of HSG A soil that was replaced by impervious cover	0.40"
	ac	Area of HSG B soil that was replaced by impervious cover	0.25"
2.25	ac	Area of HSG C soil that was replaced by impervious cover	0.10"
	ac	Area of HSG D soil or impervious cover that was replaced by impervious cover	0.0"
0.10	inches	Rd = weighted groundwater recharge depth	
0.22543	ac-in	GRV = AI * Rd	
818	cf	GRV conversion (ac-in x 43,560 sf/ac x 1ft/12”)	

Provide calculations below showing that the project meets the groundwater recharge requirements (Env-Wq 1507.04):

OPERATIONS AND MAINTENANCE FACILITY

3.2 BMP Worksheets for all Treatment Systems

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building

A. Overall Project

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **Wild Meadows TS AC 1.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
no	Yes/No	Is the system lined?	
0.64	ac	A = Area draining to the practice	
0.22	ac	A_I = Impervious area draining to the practice	
6.0	minutes	T_c = Time of Concentration	
0.34	decimal	I = percent impervious area draining to the practice, in decimal form	
0.36	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.23	ac-in	WQV= 1" x Rv x A	
835	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.36	inches	Q = water quality depth. Q = WQV/A	
91	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
0.99	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.198	inches	Ia = initial abstraction. Ia = 0.2S	
625	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.22	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
120.00	feet	L = swale length [1]	← **≥ 100'**
6.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
1,131.00	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
1,134.15	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
2.0	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
1.11	ft^2	Cross-sectional area check (assume trapezoidal channel)	
7.08	feet	Check wetted perimeter	
0.23	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
0%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
10	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
1,135.20	ft	Peak elevation of the 10-year storm event	
1,136.25	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes:

Summary for Subcatchment TSAC1: TS-AC-1.0

Runoff = 1.44 cfs @ 12.09 hrs, Volume= 0.102 af, Depth= 1.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.05	70	Woods, Good, HSG C
	0.37	71	Meadow, non-grazed, HSG C
*	0.22	96	Gravel
	0.64	80	Weighted Average
	0.64		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Less than 5 min**

Summary for Reach 15R: TS-AC-1.0

Inflow Area = 0.64 ac, 0.00% Impervious, Inflow Depth = 1.92" for 10 yr event
Inflow = 1.44 cfs @ 12.09 hrs, Volume= 0.102 af
Outflow = 1.22 cfs @ 12.14 hrs, Volume= 0.102 af, Atten= 15%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.36 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 0.10 fps, Avg. Travel Time= 20.0 min

Peak Storage= 400 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 19.89 cfs

6.00' x 2.00' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 18.00'
Length= 120.0' Slope= 0.0050 '/'
Inlet Invert= 1,134.75', Outlet Invert= 1,134.15'

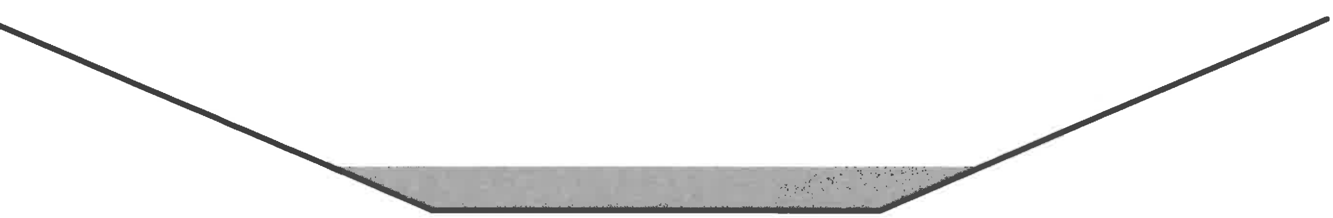

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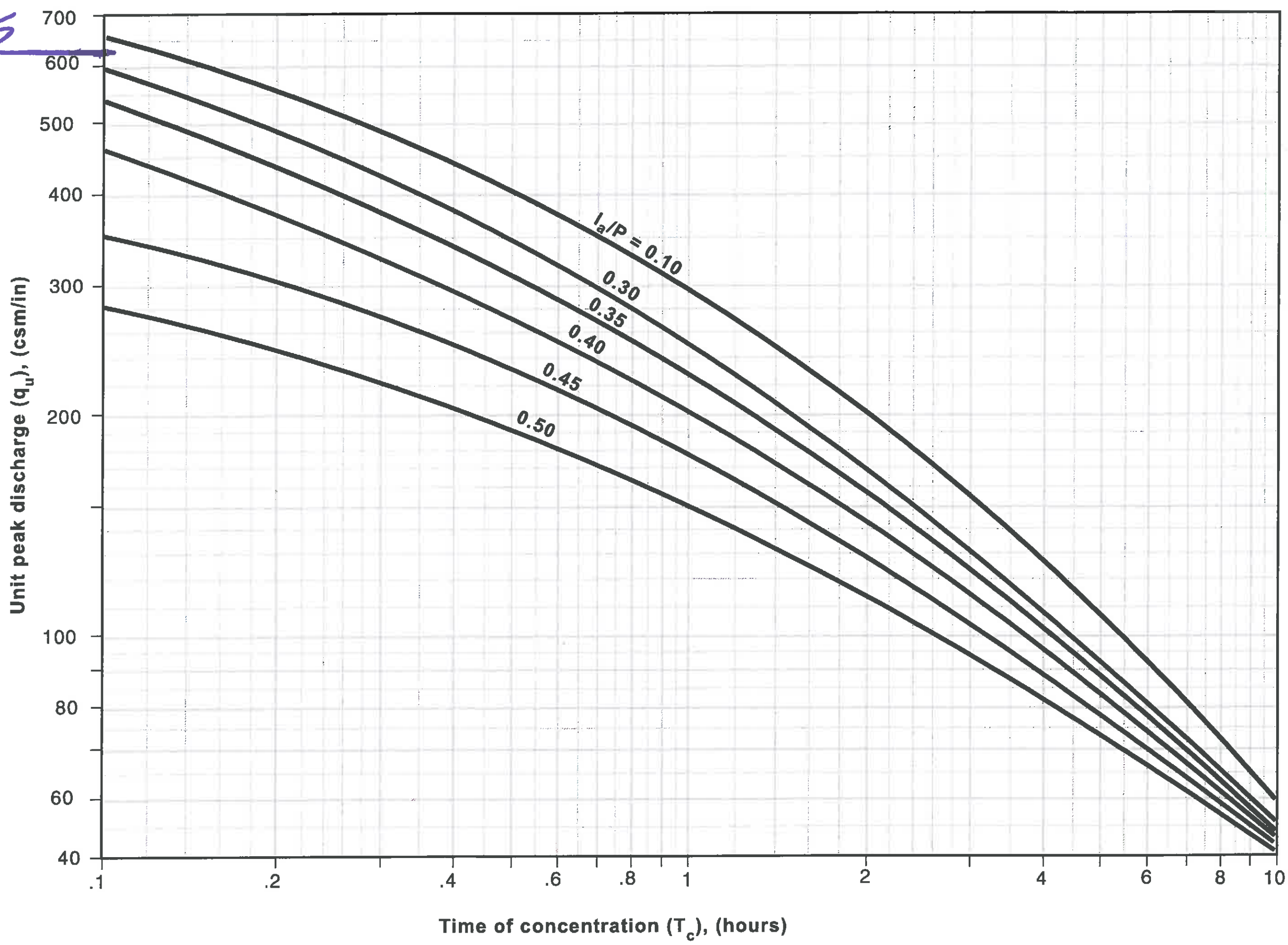
Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution

625



Ts – AC-1.0

$$I_a/P = \frac{0.198}{1''} = 0.198$$

$$T_c = \frac{6.0 \text{ MIN}}{60} = 0.1 \text{ HRS}$$

$$q_u = 625$$

Stage-Discharge for Reach 15R: TS-AC-1.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
1,134.75	0.00	0.00	1,135.27	0.39	1.55	1,135.79	0.58	5.50
1,134.76	0.03	0.00	1,135.28	0.40	1.61	1,135.80	0.58	5.61
1,134.77	0.05	0.01	1,135.29	0.40	1.66	1,135.81	0.59	5.71
1,134.78	0.07	0.01	1,135.30	0.41	1.72	1,135.82	0.59	5.81
1,134.79	0.08	0.02	1,135.31	0.41	1.77	1,135.83	0.59	5.91
1,134.80	0.09	0.03	1,135.32	0.42	1.83	1,135.84	0.60	6.02
1,134.81	0.11	0.04	1,135.33	0.42	1.89	1,135.85	0.60	6.12
1,134.82	0.12	0.05	1,135.34	0.42	1.94	1,135.86	0.60	6.23
1,134.83	0.13	0.06	1,135.35	0.43	2.00	1,135.87	0.60	6.34
1,134.84	0.14	0.08	1,135.36	0.43	2.06	1,135.88	0.61	6.44
1,134.85	0.15	0.09	1,135.37	0.44	2.13	1,135.89	0.61	6.55
1,134.86	0.15	0.11	1,135.38	0.44	2.19	1,135.90	0.61	6.66
1,134.87	0.16	0.12	1,135.39	0.44	2.25	1,135.91	0.62	6.77
1,134.88	0.17	0.14	1,135.40	0.45	2.31	1,135.92	0.62	6.89
1,134.89	0.18	0.16	1,135.41	0.45	2.38	1,135.93	0.62	7.00
1,134.90	0.19	0.18	1,135.42	0.46	2.44	1,135.94	0.62	7.11
1,134.91	0.20	0.20	1,135.43	0.46	2.51	1,135.95	0.63	7.23
1,134.92	0.20	0.23	1,135.44	0.46	2.58	1,135.96	0.63	7.34
1,134.93	0.21	0.25	1,135.45	0.47	2.65	1,135.97	0.63	7.46
1,134.94	0.22	0.27	1,135.46	0.47	2.72	1,135.98	0.64	7.58
1,134.95	0.22	0.30	1,135.47	0.47	2.79	1,135.99	0.64	7.70
1,134.96	0.23	0.32	1,135.48	0.48	2.86	1,136.00	0.64	7.82
1,134.97	0.24	0.35	1,135.49	0.48	2.93	1,136.01	0.64	7.94
1,134.98	0.24	0.38	1,135.50	0.48	3.00	1,136.02	0.65	8.06
1,134.99	0.25	0.40	1,135.51	0.49	3.07	1,136.03	0.65	8.19
1,135.00	0.26	0.43	1,135.52	0.49	3.15	1,136.04	0.65	8.31
1,135.01	0.26	0.46	1,135.53	0.50	3.22	1,136.05	0.66	8.43
1,135.02	0.27	0.50	1,135.54	0.50	3.30	1,136.06	0.66	8.56
1,135.03	0.28	0.53	1,135.55	0.50	3.38	1,136.07	0.66	8.69
1,135.04	0.28	0.56	1,135.56	0.51	3.46	1,136.08	0.66	8.82
1,135.05	0.29	0.59	1,135.57	0.51	3.53	1,136.09	0.67	8.95
1,135.06	0.29	0.63	1,135.58	0.51	3.61	1,136.10	0.67	9.08
1,135.07	0.30	0.66	1,135.59	0.52	3.69	1,136.11	0.67	9.21
1,135.08	0.30	0.70	1,135.60	0.52	3.78	1,136.12	0.67	9.34
1,135.09	0.31	0.74	1,135.61	0.52	3.86	1,136.13	0.68	9.47
1,135.10	0.31	0.78	1,135.62	0.53	3.94	1,136.14	0.68	9.61
1,135.11	0.32	0.81	1,135.63	0.53	4.03	1,136.15	0.68	9.74
1,135.12	0.32	0.85	1,135.64	0.53	4.11	1,136.16	0.68	9.88
1,135.13	0.33	0.89	1,135.65	0.54	4.20	1,136.17	0.69	10.02
1,135.14	0.33	0.94	1,135.66	0.54	4.29	1,136.18	0.69	10.16
1,135.15	0.34	0.98	1,135.67	0.54	4.37	1,136.19	0.69	10.30
1,135.16	0.34	1.02	1,135.68	0.55	4.46	1,136.20	0.70	10.44
1,135.17	0.35	1.07	1,135.69	0.55	4.55	1,136.21	0.70	10.58
1,135.18	0.35	1.11	1,135.70	0.55	4.64	1,136.22	0.70	10.72
1,135.19	0.36	1.16	1,135.71	0.56	4.74	1,136.23	0.70	10.87
1,135.20	0.36	1.20	1,135.72	0.56	4.83	1,136.24	0.71	11.01
1,135.21	0.37	1.25	1,135.73	0.56	4.92	1,136.25	0.71	11.16
1,135.22	0.37	1.30	1,135.74	0.56	5.02	1,136.26	0.71	11.31
1,135.23	0.38	1.35	1,135.75	0.57	5.11	1,136.27	0.71	11.45
1,135.24	0.38	1.40	1,135.76	0.57	5.21	1,136.28	0.72	11.60
1,135.25	0.39	1.45	1,135.77	0.57	5.31	1,136.29	0.72	11.75
1,135.26	0.39	1.50	1,135.78	0.58	5.41	1,136.30	0.72	11.91

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **TS-AC-2.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
No	Yes/No	Is the system lined?	
1.36	ac	A = Area draining to the practice	
0.08	ac	A_I = Impervious area draining to the practice	
15.2	minutes	T_c = Time of Concentration	
0.06	decimal	I = percent impervious area draining to the practice, in decimal form	
0.10	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.14	ac-in	WQV= 1" x Rv x A	
502	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.10	inches	Q = water quality depth. Q = WQV/A	
81	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
2.31	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.462	inches	Ia = initial abstraction. Ia = 0.2S	
275	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.06	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
100.00	feet	L = swale length [1]	← **≥ 100'**
4.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
1,291.17	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
1,292.50	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
1.2	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.43	ft^2	Cross-sectional area check (assume trapezoidal channel)	
4.63	feet	Check wetted perimeter	
0.06	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
4%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
12	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
1,293.17	ft	Peak elevation of the 10-year storm event	
1,294.50	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes: ESHWT > 34"

Summary for Subcatchment 3S: TS-AC-2.0

Runoff = 1.82 cfs @ 12.22 hrs, Volume= 0.177 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	20,407	70	Woods, Good, HSG C
	9,701	71	Meadow, non-grazed, HSG C
*	3,396	96	Gravel
	25,938	77	Woods, Good, HSG D
	59,442	75	Weighted Average
	59,442		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	100	0.1000	0.13		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
2.5	300	0.1570	1.98		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.0	12	0.4580	4.74		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
0.0	21	0.1570	7.37	11.05	**Trap/Vee/Rect Channel Flow, D Ditch** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
0.1	48	0.0400	9.12	11.20	**Pipe Channel, E 15" Culv** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.015 Corrugated PE, smooth interior
0.2	42	0.0190	3.59	7.19	**Trap/Vee/Rect Channel Flow, F Chan to TS** Bot.W=3.00' D=0.50' Z= 2.0 '/' Top.W=5.00' n= 0.030
15.2	523	Total			

Summary for Reach 4R: TS-AC-2.0

Inflow Area = 1.365 ac, 0.00% Impervious, Inflow Depth = 1.56" for 10 yr event
Inflow = 1.82 cfs @ 12.22 hrs, Volume= 0.177 af
Outflow = 1.72 cfs @ 12.34 hrs, Volume= 0.177 af, Atten= 6%, Lag= 7.2 min

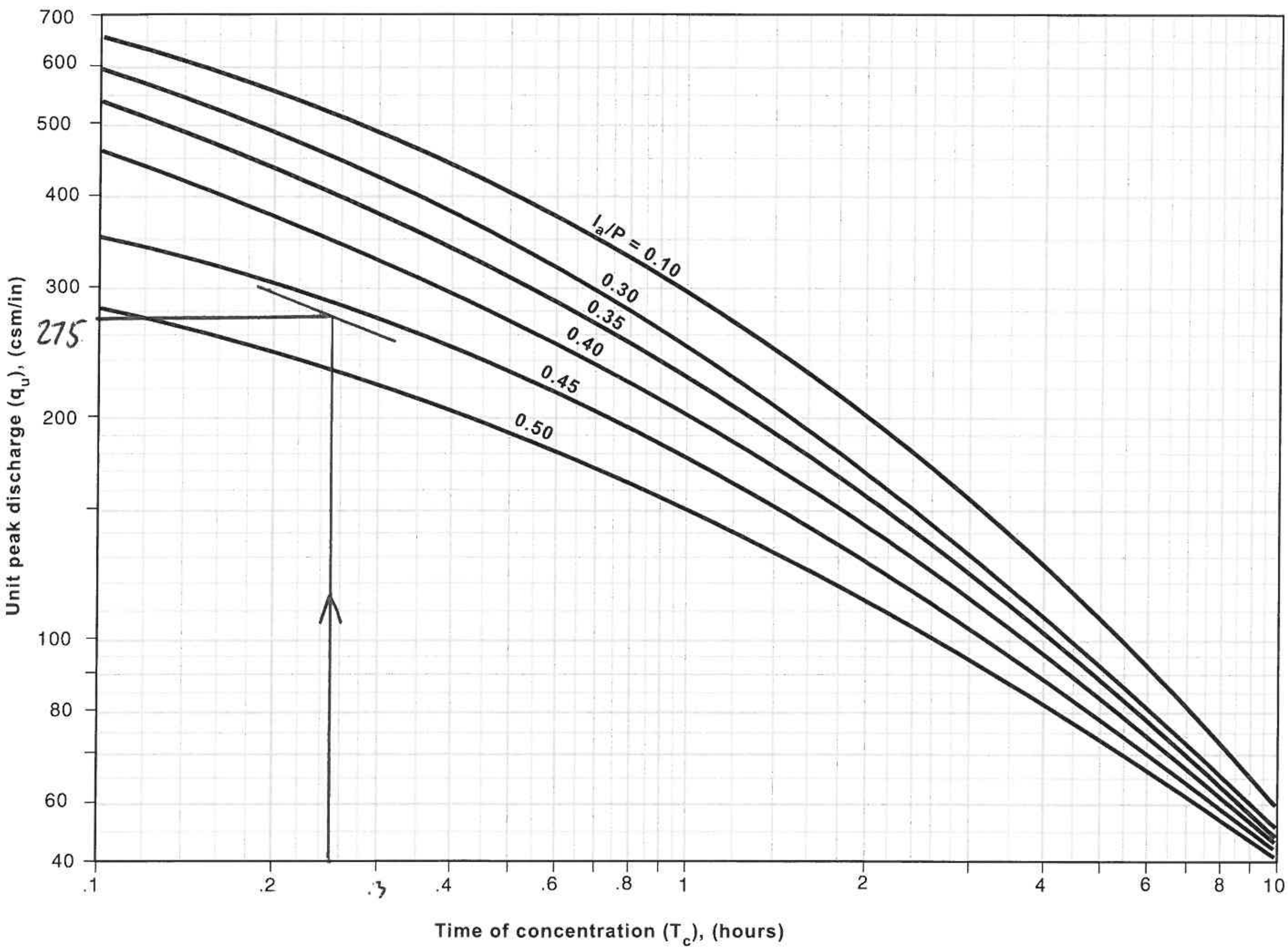
Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 0.43 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 0.14 fps, Avg. Travel Time= 11.9 min

Peak Storage= 401 cf @ 12.27 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 15.83 cfs

4.00' x 2.00' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 1,292.50', Outlet Invert= 1,292.00'

‡

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TS-AC-2.0

$I_a/P = \frac{0.462''}{1''} = 0.462$

$T_c = \frac{15.2\,min}{60} = 0.253$ hour

$\boxed{q_u = 275}$

Stage-Discharge for Reach 4R: TS-AC-2.0

	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
	1,292.50	0.00	0.00
	1,292.51	0.03	0.00
	1,292.52	0.05	0.00
	1,292.53	0.07	0.01
	1,292.54	0.08	0.01
	1,292.55	0.09	0.02
	1,292.56	0.10	0.03
	1,292.57	0.11	0.03
	1,292.58	0.12	0.04
	1,292.59	0.13	0.05
0.10'	1,292.60	0.14	0.06
	1,292.61	0.15	0.07
	1,292.62	0.16	0.08
	1,292.63	0.17	0.10
	1,292.64	0.18	0.11
	1,292.65	0.18	0.12
	1,292.66	0.19	0.14
	1,292.67	0.20	0.15
	1,292.68	0.21	0.17
	1,292.69	0.21	0.18
	1,292.70	0.22	0.20
	1,292.71	0.23	0.22
	1,292.72	0.23	0.24
	1,292.73	0.24	0.26
	1,292.74	0.24	0.28
	1,292.75	0.25	0.30
	1,292.76	0.26	0.32
	1,292.77	0.26	0.34
	1,292.78	0.27	0.36
	1,292.79	0.27	0.38
	1,292.80	0.28	0.41
	1,292.81	0.28	0.43
	1,292.82	0.29	0.46
	1,292.83	0.29	0.48
	1,292.84	0.30	0.51
	1,292.85	0.30	0.54
	1,292.86	0.31	0.56
	1,292.87	0.31	0.59
	1,292.88	0.32	0.62
	1,292.89	0.32	0.65
	1,292.90	0.33	0.68
	1,292.91	0.33	0.71
	1,292.92	0.34	0.74
	1,292.93	0.34	0.77
	1,292.94	0.34	0.81
	1,292.95	0.35	0.84
	1,292.96	0.35	0.87
	1,292.97	0.36	0.91
	1,292.98	0.36	0.94
	1,292.99	0.37	0.98
	1,293.00	0.37	1.02
	1,293.01	0.37	1.06
	1,293.02	0.38	1.09
	1,293.03	0.38	1.13
	1,293.04	0.39	1.17
	1,293.05	0.39	1.21
	1,293.06	0.39	1.25
	1,293.07	0.40	1.29
	1,293.08	0.40	1.34
	1,293.09	0.41	1.38
	1,293.10	0.41	1.42
	1,293.11	0.41	1.47
	1,293.12	0.42	1.51
	1,293.13	0.42	1.56
	1,293.14	0.42	1.61
	1,293.15	0.43	1.65
	1,293.16	0.43	1.70
	1,293.17	0.43	1.75
	1,293.18	0.44	1.80
	1,293.19	0.44	1.85
	1,293.20	0.45	1.90
	1,293.21	0.45	1.95
	1,293.22	0.45	2.01
	1,293.23	0.46	2.06
	1,293.24	0.46	2.11
	1,293.25	0.46	2.17
	1,293.26	0.47	2.22
	1,293.27	0.47	2.28
	1,293.28	0.47	2.34
	1,293.29	0.48	2.39
	1,293.30	0.48	2.45
	1,293.31	0.48	2.51
	1,293.32	0.49	2.57
	1,293.33	0.49	2.63
	1,293.34	0.49	2.69
	1,293.35	0.49	2.76
	1,293.36	0.50	2.82
	1,293.37	0.50	2.88
	1,293.38	0.50	2.95
	1,293.39	0.51	3.01
	1,293.40	0.51	3.08
	1,293.41	0.51	3.15
	1,293.42	0.52	3.21
	1,293.43	0.52	3.28
	1,293.44	0.52	3.35
	1,293.45	0.53	3.42
	1,293.46	0.53	3.49
	1,293.47	0.53	3.56
	1,293.48	0.53	3.64
	1,293.49	0.54	3.71
	1,293.50	0.54	3.78
	1,293.51	0.54	3.86
	1,293.52	0.55	3.94
	1,293.53	0.55	4.01
	1,293.54	0.55	4.09
	1,293.55	0.56	4.17
	1,293.56	0.56	4.25
	1,293.57	0.56	4.33
	1,293.58	0.56	4.41
	1,293.59	0.57	4.49
	1,293.60	0.57	4.57
	1,293.61	0.57	4.66
	1,293.62	0.58	4.74
	1,293.63	0.58	4.83
	1,293.64	0.58	4.91
	1,293.65	0.58	5.00
	1,293.66	0.59	5.09
	1,293.67	0.59	5.17
	1,293.68	0.59	5.26
	1,293.69	0.59	5.35
	1,293.70	0.60	5.45
	1,293.71	0.60	5.54
	1,293.72	0.60	5.63
	1,293.73	0.61	5.72
	1,293.74	0.61	5.82
	1,293.75	0.61	5.91
	1,293.76	0.61	6.01
	1,293.77	0.62	6.11
	1,293.78	0.62	6.21
	1,293.79	0.62	6.31
	1,293.80	0.62	6.41
	1,293.81	0.63	6.51
	1,293.82	0.63	6.61
	1,293.83	0.63	6.71
	1,293.84	0.63	6.82
	1,293.85	0.64	6.92
	1,293.86	0.64	7.03
	1,293.87	0.64	7.13
	1,293.88	0.64	7.24
	1,293.89	0.65	7.35
	1,293.90	0.65	7.46
	1,293.91	0.65	7.57
	1,293.92	0.65	7.68
	1,293.93	0.66	7.79
	1,293.94	0.66	7.90
	1,293.95	0.66	8.02
	1,293.96	0.66	8.13
	1,293.97	0.67	8.25
	1,293.98	0.67	8.37
	1,293.99	0.67	8.48
	1,294.00	**0.67**	**8.60**

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **TS-CCS-1.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Value	Unit	Description	Criteria
Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
No	Yes/No	Is the system lined?	
1.91	ac	A = Area draining to the practice	
0.11	ac	A_I = Impervious area draining to the practice	
14.5	minutes	T_c = Time of Concentration	
0.06	decimal	I = percent impervious area draining to the practice, in decimal form	
0.10	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.20	ac-in	WQV= 1" x Rv x A	
712	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.10	inches	Q = water quality depth. Q = WQV/A	
81	unitless	CN = unit peak discharge curve number. $CN = 1000/(10+5P+10Q-10*[Q^2 + 1.25*Q*P]^{0.5})$	
2.30	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.460	inches	Ia = initial abstraction. Ia = 0.2S	
270	$cfs/mi^2/in$	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.08	cfs	WQF = q_u x WQV. Conversion: to convert "$cfs/mi^2/in$ * ac-in" to "cfs" multiply by $1mi^2/640ac$	
100.00	feet	L = swale length [1]	**← ≥ 100'**
6.00	feet	w = bottom of the swale width[2]	**← 0 - 8 feet [2]**
1,469.44	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
1,467.50	feet	E_{BTM} = elevation of the bottom of the practice	**← ≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	**← ≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	**← ≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	**← 0.005 - .05**
1.1	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	**← ≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.56	ft^2	Cross-sectional area check (assume trapezoidal channel)	
6.57	feet	Check wetted perimeter	
0.08	cfs	WQF_{check}.[5]	**← WQF_{check} = WQF**
-7%		Percent difference between WQF_{check} and WQF [5]	**← +/- 10%**
11	minutes	HRT = hydraulic residence time during the WQF	**← ≥ 10 min**
1,468.12	ft	Peak elevation of the 10-year storm event	
1,469.00	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	**← yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes: ESHWT > 46"

Summary for Subcatchment 6S: TS-CCS-1.0

Runoff = 2.22 cfs @ 12.21 hrs, Volume= 0.216 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	55,667	70	Woods, Good, HSG C
	22,726	71	Meadow, non-grazed, HSG C
*	4,864	96	Gravel
	83,257	72	Weighted Average
	83,257		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	100	0.1500	0.16		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
3.6	467	0.1880	2.17		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.1	26	0.5000	4.95		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
0.3	83	0.0600	4.55	6.83	**Trap/Vee/Rect Channel Flow, D Ditch** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
14.5	676	Total			

Summary for Reach 5R: TS-CCS-1.0

Inflow Area = 1.911 ac, 0.00% Impervious, Inflow Depth = 1.36" for 10 yr event
Inflow = 2.22 cfs @ 12.21 hrs, Volume= 0.216 af
Outflow = 2.09 cfs @ 12.33 hrs, Volume= 0.216 af, Atten= 6%, Lag= 7.0 min

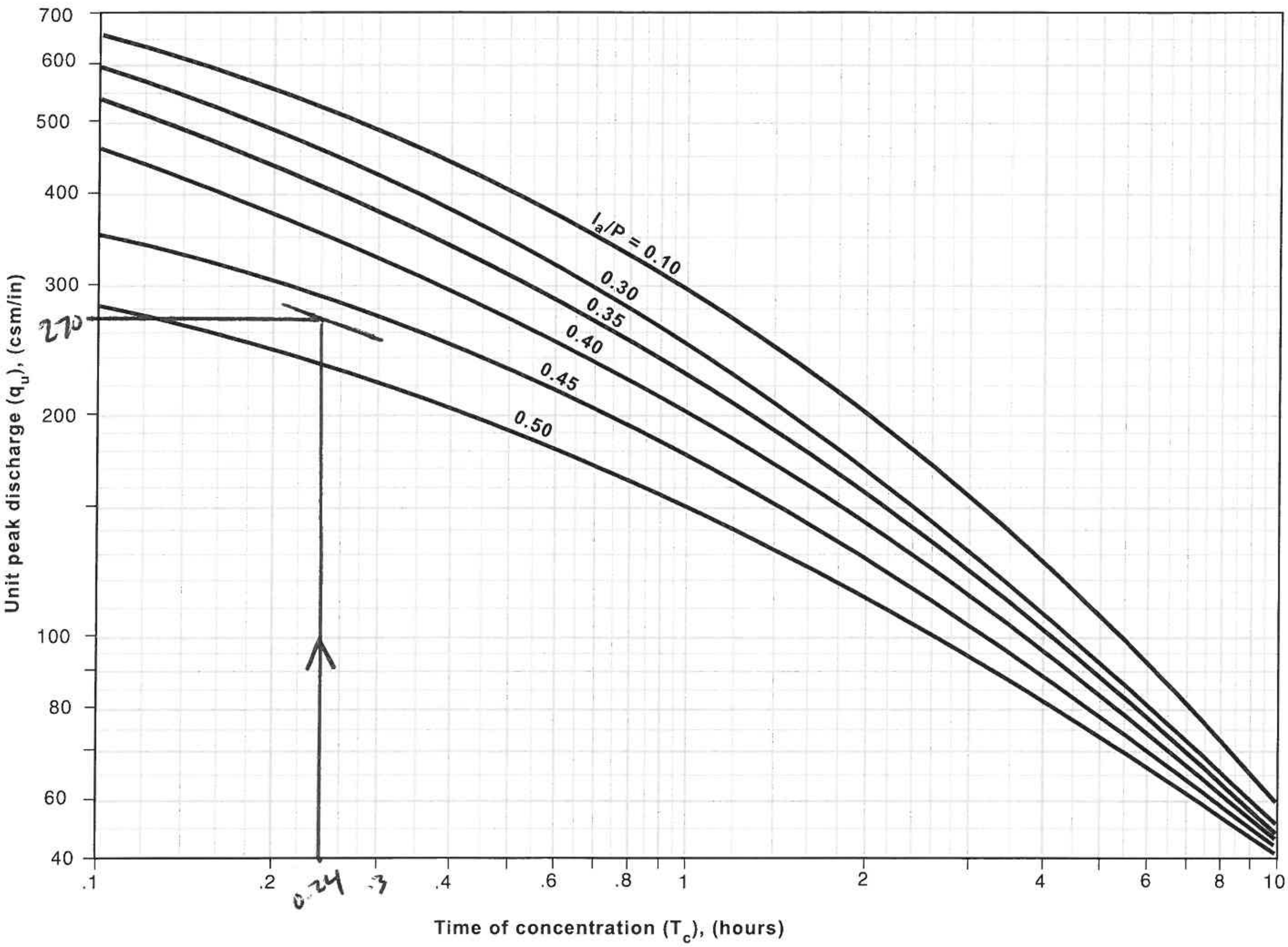
Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 0.43 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 0.13 fps, Avg. Travel Time= 12.8 min

Peak Storage= 486 cf @ 12.27 hrs
Average Depth at Peak Storage= 0.62'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.16 cfs

6.00' x 1.50' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 1,467.50', Outlet Invert= 1,467.00'

‡

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TS - CCS - 1.0

$$\frac{I_a}{P} = \frac{0.460''}{1''} = 0.460$$

$$\boxed{q_u = 270}$$

$$T_c = \frac{14.5\,min}{60} = 0.2417\ hr$$

Stage-Discharge for Reach 5R: TS-CCS-1.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
1,467.50	0.00	0.00
1,467.51	0.03	0.00
1,467.52	0.05	0.01
1,467.53	0.07	0.01
1,467.54	0.08	0.02
1,467.55	0.09	0.03
1,467.56	0.11	0.04
1,467.57	0.12	0.05
1,467.58	0.13	0.06
0.09' 1,467.59	0.14	0.08
1,467.60	0.15	0.09
1,467.61	0.15	0.11
1,467.62	0.16	0.12
1,467.63	0.17	0.14
1,467.64	0.18	0.16
1,467.65	0.19	0.18
1,467.66	0.20	0.20
1,467.67	0.20	0.23
1,467.68	0.21	0.25
1,467.69	0.22	0.27
1,467.70	0.22	0.30
1,467.71	0.23	0.32
1,467.72	0.24	0.35
1,467.73	0.24	0.38
1,467.74	0.25	0.40
1,467.75	0.26	0.43
1,467.76	0.26	0.46
1,467.77	0.27	0.50
1,467.78	0.28	0.53
1,467.79	0.28	0.56
1,467.80	0.29	0.59
1,467.81	0.29	0.63
1,467.82	0.30	0.66
1,467.83	0.30	0.70
1,467.84	0.31	0.74
1,467.85	0.31	0.78
1,467.86	0.32	0.81
1,467.87	0.32	0.85
1,467.88	0.33	0.89
1,467.89	0.33	0.94
1,467.90	0.34	0.98
1,467.91	0.34	1.02
1,467.92	0.35	1.07
1,467.93	0.35	1.11
1,467.94	0.36	1.16
1,467.95	0.36	1.20
1,467.96	0.37	1.25
1,467.97	0.37	1.30
1,467.98	0.38	1.35
1,467.99	0.38	1.40
1,468.00	0.39	1.45
1,468.01	0.39	1.50
1,468.02	0.39	1.55
1,468.03	0.40	1.61
1,468.04	0.40	1.66
1,468.05	0.41	1.72
1,468.06	0.41	1.77
1,468.07	0.42	1.83
1,468.08	0.42	1.89
1,468.09	0.42	1.94
1,468.10	0.43	2.00
1,468.11	0.43	2.06
1,468.12	0.44	2.13
1,468.13	0.44	2.19
1,468.14	0.44	2.25
1,468.15	0.45	2.31
1,468.16	0.45	2.38
1,468.17	0.46	2.44
1,468.18	0.46	2.51
1,468.19	0.46	2.58
1,468.20	0.47	2.65
1,468.21	0.47	2.72
1,468.22	0.47	2.79
1,468.23	0.48	2.86
1,468.24	0.48	2.93
1,468.25	0.48	3.00
1,468.26	0.49	3.07
1,468.27	0.49	3.15
1,468.28	0.50	3.22
1,468.29	0.50	3.30
1,468.30	0.50	3.38
1,468.31	0.51	3.46
1,468.32	0.51	3.53
1,468.33	0.51	3.61
1,468.34	0.52	3.69
1,468.35	0.52	3.78
1,468.36	0.52	3.86
1,468.37	0.53	3.94
1,468.38	0.53	4.03
1,468.39	0.53	4.11
1,468.40	0.54	4.20
1,468.41	0.54	4.29
1,468.42	0.54	4.37
1,468.43	0.55	4.46
1,468.44	0.55	4.55
1,468.45	0.55	4.64
1,468.46	0.56	4.74
1,468.47	0.56	4.83
1,468.48	0.56	4.92
1,468.49	0.56	5.02
1,468.50	0.57	5.11
1,468.51	0.57	5.21
1,468.52	0.57	5.31
1,468.53	0.58	5.41
1,468.54	0.58	5.50
1,468.55	0.58	5.61
1,468.56	0.59	5.71
1,468.57	0.59	5.81
1,468.58	0.59	5.91
1,468.59	0.60	6.02
1,468.60	0.60	6.12
1,468.61	0.60	6.23
1,468.62	0.60	6.34
1,468.63	0.61	6.44
1,468.64	0.61	6.55
1,468.65	0.61	6.66
1,468.66	0.62	6.77
1,468.67	0.62	6.89
1,468.68	0.62	7.00
1,468.69	0.62	7.11
1,468.70	0.63	7.23
1,468.71	0.63	7.34
1,468.72	0.63	7.46
1,468.73	0.64	7.58
1,468.74	0.64	7.70
1,468.75	0.64	7.82
1,468.76	0.64	7.94
1,468.77	0.65	8.06
1,468.78	0.65	8.19
1,468.79	0.65	8.31
1,468.80	0.66	8.43
1,468.81	0.66	8.56
1,468.82	0.66	8.69
1,468.83	0.66	8.82
1,468.84	0.67	8.95
1,468.85	0.67	9.08
1,468.86	0.67	9.21
1,468.87	0.67	9.34
1,468.88	0.68	9.47
1,468.89	0.68	9.61
1,468.90	0.68	9.74
1,468.91	0.68	9.88
1,468.92	0.69	10.02
1,468.93	0.69	10.16
1,468.94	0.69	10.30
1,468.95	0.70	10.44
1,468.96	0.70	10.58
1,468.97	0.70	10.72
1,468.98	0.70	10.87
1,468.99	0.71	11.01
1,469.00	**0.71**	**11.16**

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **TS-CCN-1.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
No	Yes/No	Is the system lined?	
3.53	ac	A = Area draining to the practice	
0.05	ac	A_I = Impervious area draining to the practice	
19.6	minutes	T_c = Time of Concentration	
0.01	decimal	I = percent impervious area draining to the practice, in decimal form	
0.06	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.22	ac-in	WQV= 1" x Rv x A	
793	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.06	inches	Q = water quality depth. Q = WQV/A	
78	unitless	CN = unit peak discharge curve number. $CN = 1000/(10+5P+10Q-10*[Q^2 + 1.25*Q*P]^{0.5})$	
2.77	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.554	inches	Ia = initial abstraction. Ia = 0.2S	
180	$cfs/mi^2/in$	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.06	cfs	WQF = q_u x WQV. Conversion: to convert "$cfs/mi^2/in$ * ac-in" to "cfs" multiply by $1mi^2$/640ac	
100.00	feet	L = swale length [1]	← **≥ 100'**
4.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
2,049.37	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
2,053.00	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
1.2	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.43	ft^2	Cross-sectional area check (assume trapezoidal channel)	
4.63	feet	Check wetted perimeter	
0.06	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
1%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
12	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
2,053.94	ft	Peak elevation of the 10-year storm event	
2,054.50	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes: ESHWT > 40"

Summary for Subcatchment 2S: TS-CCN-1.0

Runoff = 3.43 cfs @ 12.29 hrs, Volume= 0.380 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
*	2,039	96	Gravel
	120,111	70	Woods, Good, HSG C
	31,513	71	Meadow, non-grazed, HSG C
	153,663	71	Weighted Average
	153,663		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0	100	0.0620	0.11		**Sheet Flow, A**
					Woods: Light underbrush n= 0.400 P2= 2.65"
4.1	470	0.1450	1.90		**Shallow Concentrated Flow, B**
					Woodland Kv= 5.0 fps
0.5	200	0.1330	6.78	10.17	**Trap/Vee/Rect Channel Flow, C**
					Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00'
					n= 0.040 Mountain streams
19.6	770	Total			

Summary for Reach 1R: TS-CCN-1.0

Inflow Area = 3.528 ac, 0.00% Impervious, Inflow Depth = 1.29" for 10 yr event
Inflow = 3.43 cfs @ 12.29 hrs, Volume= 0.380 af
Outflow = 3.35 cfs @ 12.39 hrs, Volume= 0.380 af, Atten= 2%, Lag= 5.9 min

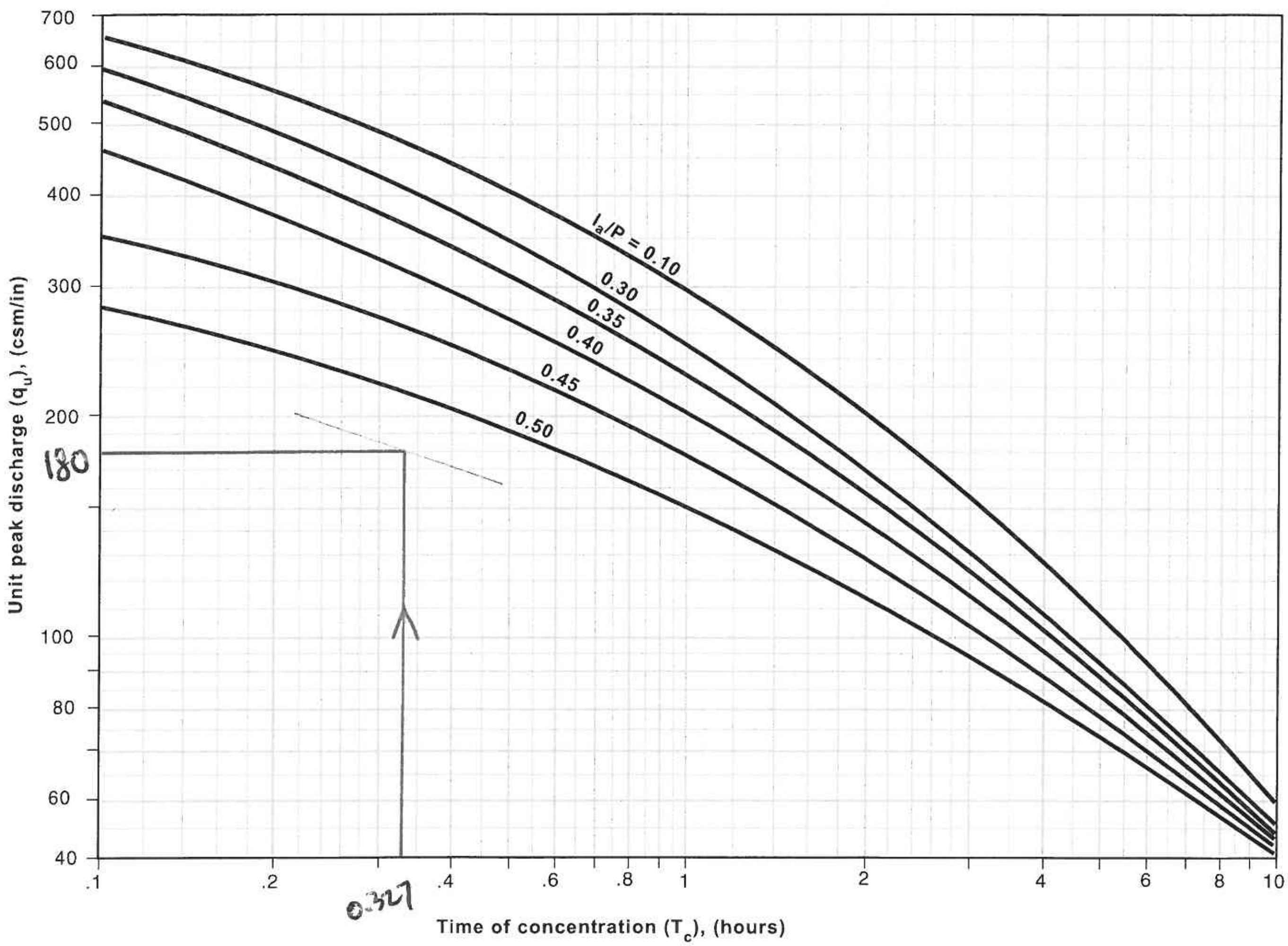
Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 0.52 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 0.17 fps, Avg. Travel Time= 9.6 min

Peak Storage= 642 cf @ 12.34 hrs
Average Depth at Peak Storage= 0.94'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 8.60 cfs

4.00' x 1.50' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 13.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 2,053.00', Outlet Invert= 2,052.50'

‡

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TS-CCN-1.0

$$I_a/P = \frac{0.554''}{1.0''} = 0.554$$

$$\boxed{q_u = 180}$$

$$T_c = \frac{19.6\ \text{min}}{60} = 0.327\ \text{hr}$$

Stage-Discharge for Reach 1R: TS-CCN-1.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
2,053.00	0.00	0.00
2,053.01	0.03	0.00
2,053.02	0.05	0.00
2,053.03	0.07	0.01
2,053.04	0.08	0.01
2,053.05	0.09	0.02
2,053.06	0.10	0.03
2,053.07	0.11	0.03
2,053.08	0.12	0.04
2,053.09	0.13	0.05
0.10' 2,053.10	0.14	0.06
2,053.11	0.15	0.07
2,053.12	0.16	0.08
2,053.13	0.17	0.10
2,053.14	0.18	0.11
2,053.15	0.18	0.12
2,053.16	0.19	0.14
2,053.17	0.20	0.15
2,053.18	0.21	0.17
2,053.19	0.21	0.18
2,053.20	0.22	0.20
2,053.21	0.23	0.22
2,053.22	0.23	0.24
2,053.23	0.24	0.26
2,053.24	0.24	0.28
2,053.25	0.25	0.30
2,053.26	0.26	0.32
2,053.27	0.26	0.34
2,053.28	0.27	0.36
2,053.29	0.27	0.38
2,053.30	0.28	0.41
2,053.31	0.28	0.43
2,053.32	0.29	0.46
2,053.33	0.29	0.48
2,053.34	0.30	0.51
2,053.35	0.30	0.54
2,053.36	0.31	0.56
2,053.37	0.31	0.59
2,053.38	0.32	0.62
2,053.39	0.32	0.65
2,053.40	0.33	0.68
2,053.41	0.33	0.71
2,053.42	0.34	0.74
2,053.43	0.34	0.77
2,053.44	0.34	0.81
2,053.45	0.35	0.84
2,053.46	0.35	0.87
2,053.47	0.36	0.91
2,053.48	0.36	0.94
2,053.49	0.37	0.98
2,053.50	0.37	1.02
2,053.51	0.37	1.06
2,053.52	0.38	1.09
2,053.53	0.38	1.13
2,053.54	0.39	1.17
2,053.55	0.39	1.21
2,053.56	0.39	1.25
2,053.57	0.40	1.29
2,053.58	0.40	1.34
2,053.59	0.41	1.38
2,053.60	0.41	1.42
2,053.61	0.41	1.47
2,053.62	0.42	1.51
2,053.63	0.42	1.56
2,053.64	0.42	1.61
2,053.65	0.43	1.65
2,053.66	0.43	1.70
2,053.67	0.43	1.75
2,053.68	0.44	1.80
2,053.69	0.44	1.85
2,053.70	0.45	1.90
2,053.71	0.45	1.95
2,053.72	0.45	2.01
2,053.73	0.46	2.06
2,053.74	0.46	2.11
2,053.75	0.46	2.17
2,053.76	0.47	2.22
2,053.77	0.47	2.28
2,053.78	0.47	2.34
2,053.79	0.48	2.39
2,053.80	0.48	2.45
2,053.81	0.48	2.51
2,053.82	0.49	2.57
2,053.83	0.49	2.63
2,053.84	0.49	2.69
2,053.85	0.49	2.76
2,053.86	0.50	2.82
2,053.87	0.50	2.88
2,053.88	0.50	2.95
2,053.89	0.51	3.01
2,053.90	0.51	3.08
2,053.91	0.51	3.15
2,053.92	0.52	3.21
2,053.93	0.52	3.28
2,053.94	0.52	3.35
2,053.95	0.53	3.42
2,053.96	0.53	3.49
2,053.97	0.53	3.56
2,053.98	0.53	3.64
2,053.99	0.54	3.71
2,054.00	0.54	3.78
2,054.01	0.54	3.86
2,054.02	0.55	3.94
2,054.03	0.55	4.01
2,054.04	0.55	4.09
2,054.05	0.56	4.17
2,054.06	0.56	4.25
2,054.07	0.56	4.33
2,054.08	0.56	4.41
2,054.09	0.57	4.49
2,054.10	0.57	4.57
2,054.11	0.57	4.66
2,054.12	0.58	4.74
2,054.13	0.58	4.83
2,054.14	0.58	4.91
2,054.15	0.58	5.00
2,054.16	0.59	5.09
2,054.17	0.59	5.17
2,054.18	0.59	5.26
2,054.19	0.59	5.35
2,054.20	0.60	5.45
2,054.21	0.60	5.54
2,054.22	0.60	5.63
2,054.23	0.61	5.72
2,054.24	0.61	5.82
2,054.25	0.61	5.91
2,054.26	0.61	6.01
2,054.27	0.62	6.11
2,054.28	0.62	6.21
2,054.29	0.62	6.31
2,054.30	0.62	6.41
2,054.31	0.63	6.51
2,054.32	0.63	6.61
2,054.33	0.63	6.71
2,054.34	0.63	6.82
2,054.35	0.64	6.92
2,054.36	0.64	7.03
2,054.37	0.64	7.13
2,054.38	0.64	7.24
2,054.39	0.65	7.35
2,054.40	0.65	7.46
2,054.41	0.65	7.57
2,054.42	0.65	7.68
2,054.43	0.66	7.79
2,054.44	0.66	7.90
2,054.45	0.66	8.02
2,054.46	0.66	8.13
2,054.47	0.67	8.25
2,054.48	0.67	8.37
2,054.49	0.67	8.48
2,054.50	**0.67**	**8.60**

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **TS-CCN-2.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Value	Units	Description	Criteria
Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
No	Yes/No	Is the system lined?	
1.94	ac	A = Area draining to the practice	
0.25	ac	A_I = Impervious area draining to the practice	
14.3	minutes	T_c = Time of Concentration	
0.13	decimal	I = percent impervious area draining to the practice, in decimal form	
0.17	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.32	ac-in	WQV= 1" x Rv x A	
1,169	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.17	inches	Q = water quality depth. Q = WQV/A	
85	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
1.81	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.362	inches	Ia = initial abstraction. Ia = 0.2S	
390	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.20	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
120.00	feet	L = swale length [1]	← **≥ 100'**
6.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
1,939.67	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
1,942.50	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
1.9	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
1.04	ft^2	Cross-sectional area check (assume trapezoidal channel)	
7.01	feet	Check wetted perimeter	
0.20	cfs	WQF_{check}.[5]	← **WQF_{check} = WQF**
4%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
11	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
1,943.31	ft	Peak elevation of the 10-year storm event	
1,944.00	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes: ESHWT > 28"

Summary for Subcatchment 3S: TS-CCN-2.0

Runoff = 3.63 cfs @ 12.21 hrs, Volume= 0.341 af, Depth= 1.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	20,714	70	Woods, Good, HSG C
	8,409	71	Meadow, non-grazed, HSG C
*	1,399	96	Gravel
	31,362	77	Woods, Good, HSG D
	33,791	78	Meadow, non-grazed, HSG D
*	9,531	96	Gravel
	105,206	77	Weighted Average
	105,206		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	100	0.1020	0.14		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
0.3	81	0.3470	4.12		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.9	329	0.1020	5.94	8.91	**Trap/Vee/Rect Channel Flow, C Ditch** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
0.1	60	0.0330	8.29	10.17	**Pipe Channel, D CV-CCN-2.4** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.015 Corrugated PE, smooth interior
0.7	78	0.0090	1.76	2.65	**Trap/Vee/Rect Channel Flow, E Ditch** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
14.3	648	Total			

Summary for Reach 4R: TS-CCN-2.0

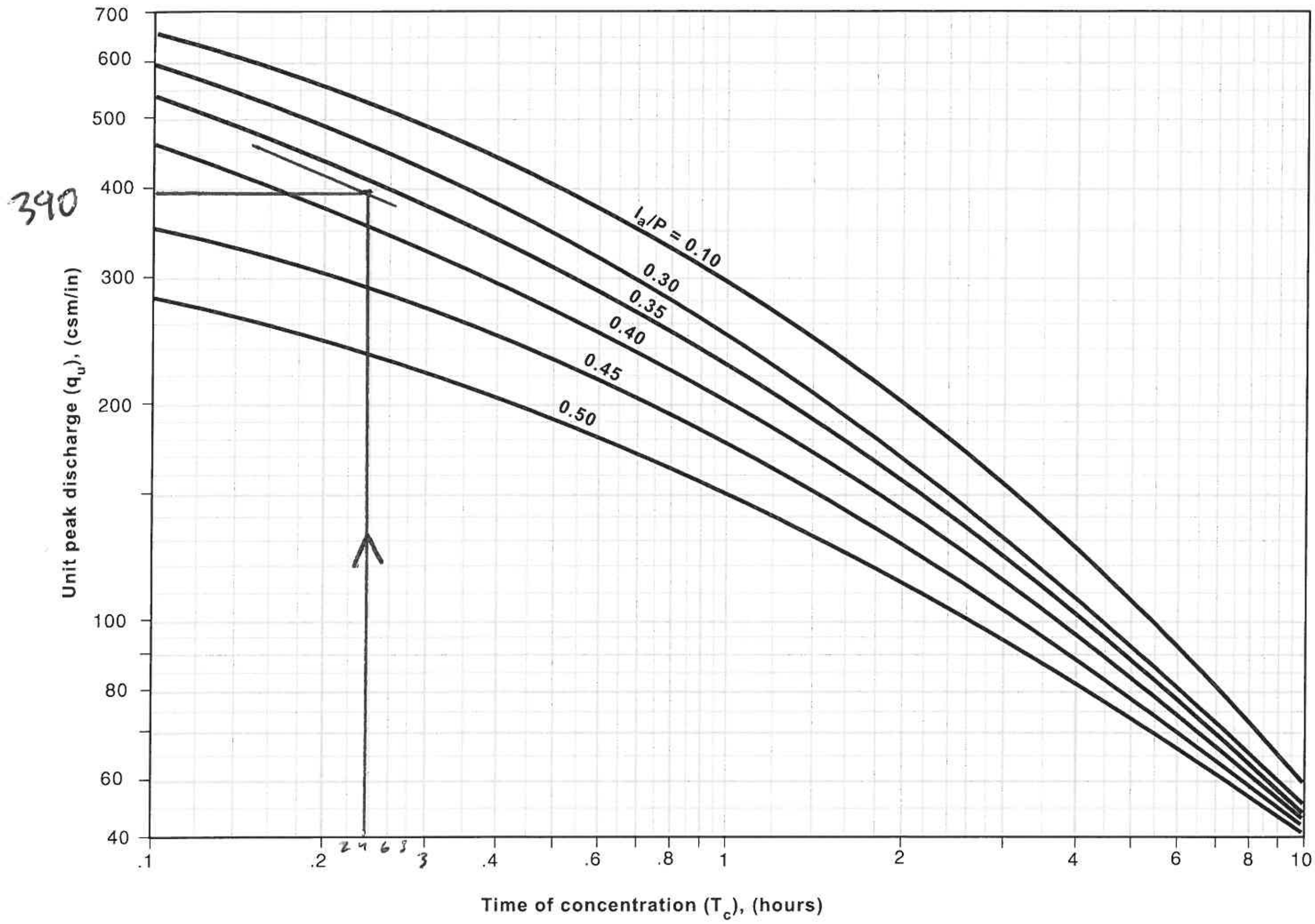
Inflow Area = 2.415 ac, 0.00% Impervious, Inflow Depth = 1.70" for 10 yr event
Inflow = 3.63 cfs @ 12.21 hrs, Volume= 0.341 af
Outflow = 3.41 cfs @ 12.32 hrs, Volume= 0.341 af, Atten= 6%, Lag= 7.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 0.51 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 0.14 fps, Avg. Travel Time= 14.1 min

Peak Storage= 819 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.16 cfs

6.00' x 1.50' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 120.0' Slope= 0.0050 '/'
Inlet Invert= 1,942.50', Outlet Invert= 1,941.90'

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TS-CCN-2.0

$$I_a/P = \frac{0.362''}{1''} = 0.362$$

$$\boxed{q_u = 390}$$

$$T_c = \frac{14.3\,\text{min}}{60} = 0.238\,\text{hr}$$

Stage-Discharge for Reach 4R: TS-CCN-2.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
1,942.50	0.00	0.00
1,942.51	0.03	0.00
1,942.52	0.05	0.01
1,942.53	0.07	0.01
1,942.54	0.08	0.02
1,942.55	0.09	0.03
1,942.56	0.11	0.04
1,942.57	0.12	0.05
1,942.58	0.13	0.06
1,942.59	0.14	0.08
1,942.60	0.15	0.09
1,942.61	0.15	0.11
1,942.62	0.16	0.12
1,942.63	0.17	0.14
1,942.64	0.18	0.16
1,942.65	0.19	0.18
0.16' 1,942.66	0.20	0.20
1,942.67	0.20	0.23
1,942.68	0.21	0.25
1,942.69	0.22	0.27
1,942.70	0.22	0.30
1,942.71	0.23	0.32
1,942.72	0.24	0.35
1,942.73	0.24	0.38
1,942.74	0.25	0.40
1,942.75	0.26	0.43
1,942.76	0.26	0.46
1,942.77	0.27	0.50
1,942.78	0.28	0.53
1,942.79	0.28	0.56
1,942.80	0.29	0.59
1,942.81	0.29	0.63
1,942.82	0.30	0.66
1,942.83	0.30	0.70
1,942.84	0.31	0.74
1,942.85	0.31	0.78
1,942.86	0.32	0.81
1,942.87	0.32	0.85
1,942.88	0.33	0.89
1,942.89	0.33	0.94
1,942.90	0.34	0.98
1,942.91	0.34	1.02
1,942.92	0.35	1.07
1,942.93	0.35	1.11
1,942.94	0.36	1.16
1,942.95	0.36	1.20
1,942.96	0.37	1.25
1,942.97	0.37	1.30
1,942.98	0.38	1.35
1,942.99	0.38	1.40
1,943.00	0.39	1.45
1,943.01	0.39	1.50
1,943.02	0.39	1.55
1,943.03	0.40	1.61
1,943.04	0.40	1.66
1,943.05	0.41	1.72
1,943.06	0.41	1.77
1,943.07	0.42	1.83
1,943.08	0.42	1.89
1,943.09	0.42	1.94
1,943.10	0.43	2.00
1,943.11	0.43	2.06
1,943.12	0.44	2.13
1,943.13	0.44	2.19
1,943.14	0.44	2.25
1,943.15	0.45	2.31
1,943.16	0.45	2.38
1,943.17	0.46	2.44
1,943.18	0.46	2.51
1,943.19	0.46	2.58
1,943.20	0.47	2.65
1,943.21	0.47	2.72
1,943.22	0.47	2.79
1,943.23	0.48	2.86
1,943.24	0.48	2.93
1,943.25	0.48	3.00
1,943.26	0.49	3.07
1,943.27	0.49	3.15
1,943.28	0.50	3.22
1,943.29	0.50	3.30
1,943.30	0.50	3.38
1,943.31	0.51	3.46
1,943.32	0.51	3.53
1,943.33	0.51	3.61
1,943.34	0.52	3.69
1,943.35	0.52	3.78
1,943.36	0.52	3.86
1,943.37	0.53	3.94
1,943.38	0.53	4.03
1,943.39	0.53	4.11
1,943.40	0.54	4.20
1,943.41	0.54	4.29
1,943.42	0.54	4.37
1,943.43	0.55	4.46
1,943.44	0.55	4.55
1,943.45	0.55	4.64
1,943.46	0.56	4.74
1,943.47	0.56	4.83
1,943.48	0.56	4.92
1,943.49	0.56	5.02
1,943.50	0.57	5.11
1,943.51	0.57	5.21
1,943.52	0.57	5.31
1,943.53	0.58	5.41
1,943.54	0.58	5.50
1,943.55	0.58	5.61
1,943.56	0.59	5.71
1,943.57	0.59	5.81
1,943.58	0.59	5.91
1,943.59	0.60	6.02
1,943.60	0.60	6.12
1,943.61	0.60	6.23
1,943.62	0.60	6.34
1,943.63	0.61	6.44
1,943.64	0.61	6.55
1,943.65	0.61	6.66
1,943.66	0.62	6.77
1,943.67	0.62	6.89
1,943.68	0.62	7.00
1,943.69	0.62	7.11
1,943.70	0.63	7.23
1,943.71	0.63	7.34
1,943.72	0.63	7.46
1,943.73	0.64	7.58
1,943.74	0.64	7.70
1,943.75	0.64	7.82
1,943.76	0.64	7.94
1,943.77	0.65	8.06
1,943.78	0.65	8.19
1,943.79	0.65	8.31
1,943.80	0.66	8.43
1,943.81	0.66	8.56
1,943.82	0.66	8.69
1,943.83	0.66	8.82
1,943.84	0.67	8.95
1,943.85	0.67	9.08
1,943.86	0.67	9.21
1,943.87	0.67	9.34
1,943.88	0.68	9.47
1,943.89	0.68	9.61
1,943.90	0.68	9.74
1,943.91	0.68	9.88
1,943.92	0.69	10.02
1,943.93	0.69	10.16
1,943.94	0.69	10.30
1,943.95	0.70	10.44
1,943.96	0.70	10.58
1,943.97	0.70	10.72
1,943.98	0.70	10.87
1,943.99	0.71	11.01
1,944.00	**0.71**	**11.16**

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **TS-CEC-1.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
No	Yes/No	Is the system lined?	
1.12	ac	A = Area draining to the practice	
0.14	ac	A_I = Impervious area draining to the practice	
15.4	minutes	T_c = Time of Concentration	
0.12	decimal	I = percent impervious area draining to the practice, in decimal form	
0.16	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.18	ac-in	WQV= 1" x Rv x A	
650	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.16	inches	Q = water quality depth. Q = WQV/A	
84	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P] $^{0.5}$)	
1.85	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.369	inches	Ia = initial abstraction. Ia = 0.2S	
380	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.11	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
100.00	feet	L = swale length [1]	← ≥ 100'
6.00	feet	w = bottom of the swale width[2]	← 0 - 8 feet [2]
	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
1,821.50	feet	E_{BTM} = elevation of the bottom of the practice	← ≥ E_{SHWT}
3.0	:1	SS_{RIGHT} = right Side slope	← ≥3:1
3.0	:1	SS_{LEFT} = left Side slope	← ≥3:1
0.005	ft/ft	S = slope of swale in decimal form[3]	← 0.005 - .05
1.3	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← ≤ 4"
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.70	ft^2	Cross-sectional area check (assume trapezoidal channel)	
6.70	feet	Check wetted perimeter	
0.11	cfs	WQF_{check}.[5] ← WQF_{check} = WQF	
2%		Percent difference between WQF_{check} and WQF [5]	← +/- 10%
11	minutes	HRT = hydraulic residence time during the WQF	← ≥ 10 min
1,821.81	ft	Peak elevation of the 10-year storm event	
1,823.00	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← yes

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes: ESHWT = 26"

Summary for Subcatchment 7S: TS-CEC-1.0

Runoff = 0.56 cfs @ 12.26 hrs, Volume= 0.069 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.137	96	Gravel
	0.532	58	Meadow, non-grazed, HSG B
	0.446	55	Woods, Good, HSG B
	1.115	61	Weighted Average
	1.115		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	100	0.0890	0.13		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
1.8	248	0.2020	2.25		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.5	66	0.0830	2.02		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
0.1	36	0.0400	10.53	12.92	**Pipe Channel, D** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
15.4	450	Total			

Summary for Reach 8R: TS-CEC-1.0

Inflow Area = 1.115 ac, 0.00% Impervious, Inflow Depth = 0.74" for 10 yr event
Inflow = 0.56 cfs @ 12.26 hrs, Volume= 0.069 af
Outflow = 0.52 cfs @ 12.46 hrs, Volume= 0.069 af, Atten= 8%, Lag= 11.9 min

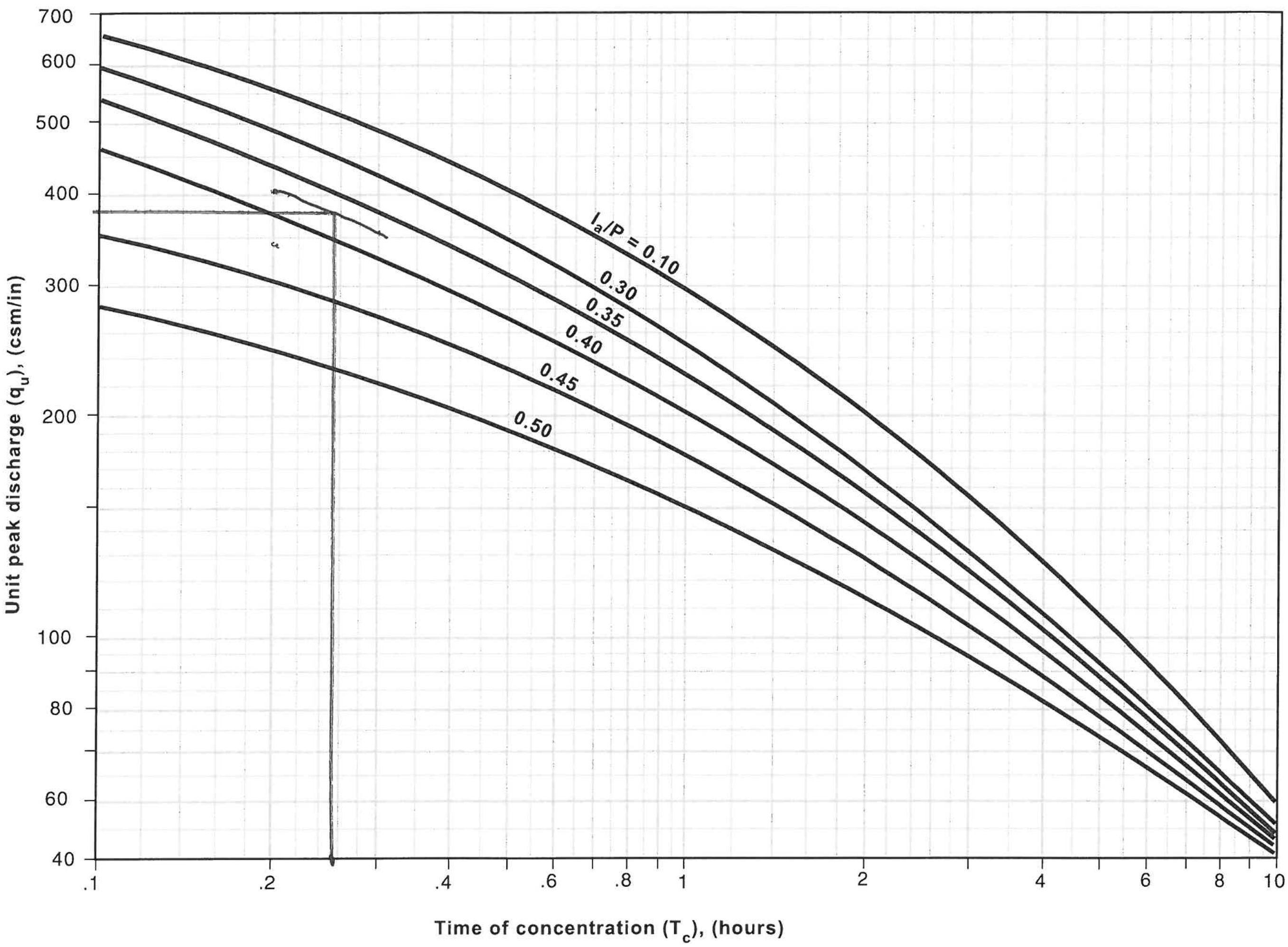
Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 0.27 fps, Min. Travel Time= 6.1 min
Avg. Velocity = 0.09 fps, Avg. Travel Time= 17.6 min

Peak Storage= 189 cf @ 12.36 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.16 cfs

6.00' x 1.50' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 1,821.90', Outlet Invert= 1,821.40'

‡

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TS-CEC-1.0

$$\frac{I_a}{P} = \frac{0.369''}{1''} = 0.369$$

$$q_u = 380$$

$$T_c = \frac{15.4 \text{ min}}{60} = 0.257 \text{ hr}$$

Stage-Discharge for Reach 8R: TS-CEC-1.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
1,821.90	0.00	0.00
1,821.91	0.03	0.00
1,821.92	0.05	0.01
1,821.93	0.07	0.01
1,821.94	0.08	0.02
1,821.95	0.09	0.03
1,821.96	0.11	0.04
1,821.97	0.12	0.05
1,821.98	0.13	0.06
1,821.99	0.14	0.08
1,822.00	0.15	0.09
1,822.01	0.15	0.11
1,822.02	0.16	0.12
1,822.03	0.17	0.14
1,822.04	0.18	0.16
1,822.05	0.19	0.18
1,822.06	0.20	0.20
1,822.07	0.20	0.23
1,822.08	0.21	0.25
1,822.09	0.22	0.27
1,822.10	0.22	0.30
1,822.11	0.23	0.32
1,822.12	0.24	0.35
1,822.13	0.24	0.38
1,822.14	0.25	0.40
1,822.15	0.26	0.43
1,822.16	0.26	0.46
1,822.17	0.27	0.50
1,822.18	0.28	0.53
1,822.19	0.28	0.56
1,822.20	0.29	0.59
1,822.21	0.29	0.63
1,822.22	0.30	0.66
1,822.23	0.30	0.70
1,822.24	0.31	0.74
1,822.25	0.31	0.78
1,822.26	0.32	0.81
1,822.27	0.32	0.85
1,822.28	0.33	0.89
1,822.29	0.33	0.94
1,822.30	0.34	0.98
1,822.31	0.34	1.02
1,822.32	0.35	1.07
1,822.33	0.35	1.11
1,822.34	0.36	1.16
1,822.35	0.36	1.20
1,822.36	0.37	1.25
1,822.37	0.37	1.30
1,822.38	0.38	1.35
1,822.39	0.38	1.40
1,822.40	0.39	1.45
1,822.41	0.39	1.50
1,822.42	0.39	1.55
1,822.43	0.40	1.61
1,822.44	0.40	1.66
1,822.45	0.41	1.72
1,822.46	0.41	1.77
1,822.47	0.42	1.83
1,822.48	0.42	1.89
1,822.49	0.42	1.94
1,822.50	0.43	2.00
1,822.51	0.43	2.06
1,822.52	0.44	2.13
1,822.53	0.44	2.19
1,822.54	0.44	2.25
1,822.55	0.45	2.31
1,822.56	0.45	2.38
1,822.57	0.46	2.44
1,822.58	0.46	2.51
1,822.59	0.46	2.58
1,822.60	0.47	2.65
1,822.61	0.47	2.72
1,822.62	0.47	2.79
1,822.63	0.48	2.86
1,822.64	0.48	2.93
1,822.65	0.48	3.00
1,822.66	0.49	3.07
1,822.67	0.49	3.15
1,822.68	0.50	3.22
1,822.69	0.50	3.30
1,822.70	0.50	3.38
1,822.71	0.51	3.46
1,822.72	0.51	3.53
1,822.73	0.51	3.61
1,822.74	0.52	3.69
1,822.75	0.52	3.78
1,822.76	0.52	3.86
1,822.77	0.53	3.94
1,822.78	0.53	4.03
1,822.79	0.53	4.11
1,822.80	0.54	4.20
1,822.81	0.54	4.29
1,822.82	0.54	4.37
1,822.83	0.55	4.46
1,822.84	0.55	4.55
1,822.85	0.55	4.64
1,822.86	0.56	4.74
1,822.87	0.56	4.83
1,822.88	0.56	4.92
1,822.89	0.56	5.02
1,822.90	0.57	5.11
1,822.91	0.57	5.21
1,822.92	0.57	5.31
1,822.93	0.58	5.41
1,822.94	0.58	5.50
1,822.95	0.58	5.61
1,822.96	0.59	5.71
1,822.97	0.59	5.81
1,822.98	0.59	5.91
1,822.99	0.60	6.02
1,823.00	0.60	6.12
1,823.01	0.60	6.23
1,823.02	0.60	6.34
1,823.03	0.61	6.44
1,823.04	0.61	6.55
1,823.05	0.61	6.66
1,823.06	0.62	6.77
1,823.07	0.62	6.89
1,823.08	0.62	7.00
1,823.09	0.62	7.11
1,823.10	0.63	7.23
1,823.11	0.63	7.34
1,823.12	0.63	7.46
1,823.13	0.64	7.58
1,823.14	0.64	7.70
1,823.15	0.64	7.82
1,823.16	0.64	7.94
1,823.17	0.65	8.06
1,823.18	0.65	8.19
1,823.19	0.65	8.31
1,823.20	0.66	8.43
1,823.21	0.66	8.56
1,823.22	0.66	8.69
1,823.23	0.66	8.82
1,823.24	0.67	8.95
1,823.25	0.67	9.08
1,823.26	0.67	9.21
1,823.27	0.67	9.34
1,823.28	0.68	9.47
1,823.29	0.68	9.61
1,823.30	0.68	9.74
1,823.31	0.68	9.88
1,823.32	0.69	10.02
1,823.33	0.69	10.16
1,823.34	0.69	10.30
1,823.35	0.70	10.44
1,823.36	0.70	10.58
1,823.37	0.70	10.72
1,823.38	0.70	10.87
1,823.39	0.71	11.01
1,823.40	**0.71**	**11.16**

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **TS-CEC-2.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
No	Yes/No	Is the system lined?	
0.31	ac	A = Area draining to the practice	
0.07	ac	A_I = Impervious area draining to the practice	
5.9	minutes	T_c = Time of Concentration	
0.23	decimal	I = percent impervious area draining to the practice, in decimal form	
0.25	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.08	ac-in	WQV= 1" x Rv x A	
285	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.25	inches	Q = water quality depth. Q = WQV/A	
88	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
1.36	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.272	inches	Ia = initial abstraction. Ia = 0.2S	
600	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.07	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
100.00	feet	L = swale length [1]	← **≥ 100'**
6.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
1,803.07	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
1,803.50	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
1.0	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.53	ft^2	Cross-sectional area check (assume trapezoidal channel)	
6.54	feet	Check wetted perimeter	
0.07	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
-5%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
12	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
1,803.80	ft	Peak elevation of the 10-year storm event	
1,805.00	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes: ESHWT > 30"

Summary for Subcatchment 9S: TS-CEC-2.0

Runoff = 0.60 cfs @ 12.09 hrs, Volume= 0.044 af, Depth= 1.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.070	96	Gravel
	0.235	71	Meadow, non-grazed, HSG C
	0.004	70	Woods, Good, HSG C
	0.309	77	Weighted Average
	0.309		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	100	0.1100	0.31		**Sheet Flow, A** Grass: Short n= 0.150 P2= 2.65"
0.4	42	0.1070	1.64		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.1	36	0.0140	6.23	7.64	**Pipe Channel, C** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
5.9	178	Total			

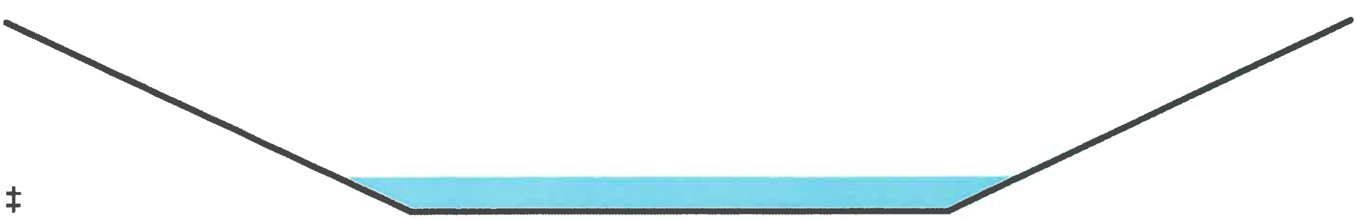
Summary for Reach 10R: TS-CEC-2.0

Inflow Area = 0.309 ac, 0.00% Impervious, Inflow Depth = 1.70" for 10 yr event
Inflow = 0.60 cfs @ 12.09 hrs, Volume= 0.044 af
Outflow = 0.49 cfs @ 12.26 hrs, Volume= 0.044 af, Atten= 17%, Lag= 9.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 0.27 fps, Min. Travel Time= 6.2 min
Avg. Velocity = 0.08 fps, Avg. Travel Time= 22.1 min

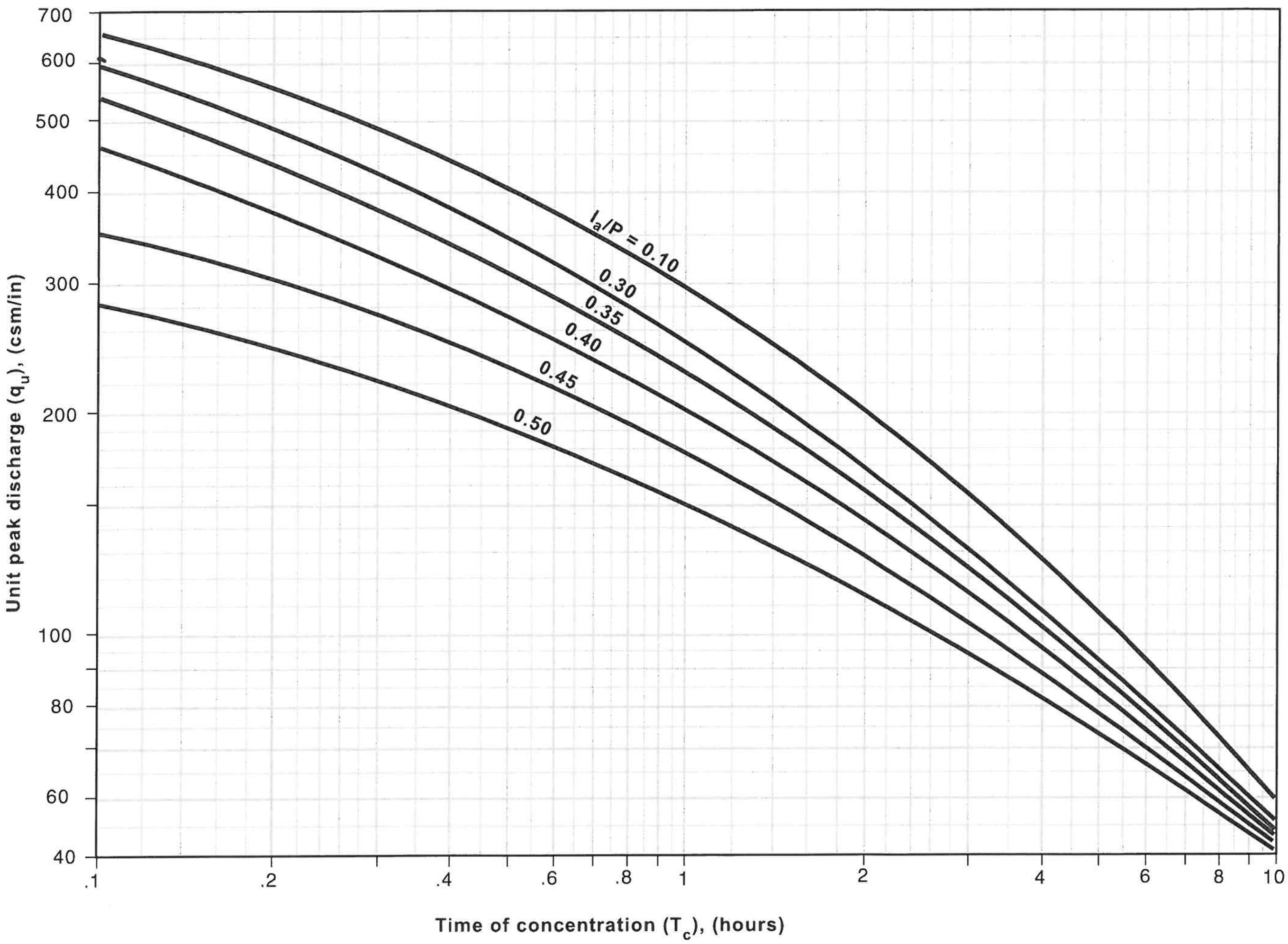
Peak Storage= 184 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.16 cfs

6.00' x 1.50' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 1,803.50', Outlet Invert= 1,803.00'



‡

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TS- CEC - 2.0

$$\frac{I_a}{P} = \frac{0.272''}{1''} = 0.272$$

$$q_u = 600$$

$$T_c = \frac{5.9 \text{ min}}{60} = 0.1 \text{ hr}$$

Stage-Discharge for Reach 10R: TS-CEC-2.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
1,803.50	0.00	0.00
1,803.51	0.03	0.00
1,803.52	0.05	0.01
1,803.53	0.07	0.01
1,803.54	0.08	0.02
1,803.55	0.09	0.03
1,803.56	0.11	0.04
1,803.57	0.12	0.05
1,803.58	0.13	0.06
1,803.59	0.14	0.08
1,803.60	0.15	0.09
1,803.61	0.15	0.11
1,803.62	0.16	0.12
1,803.63	0.17	0.14
1,803.64	0.18	0.16
1,803.65	0.19	0.18
1,803.66	0.20	0.20
1,803.67	0.20	0.23
1,803.68	0.21	0.25
1,803.69	0.22	0.27
1,803.70	0.22	0.30
1,803.71	0.23	0.32
1,803.72	0.24	0.35
1,803.73	0.24	0.38
1,803.74	0.25	0.40
1,803.75	0.26	0.43
1,803.76	0.26	0.46
1,803.77	0.27	0.50
1,803.78	0.28	0.53
1,803.79	0.28	0.56
1,803.80	0.29	0.59
1,803.81	0.29	0.63
1,803.82	0.30	0.66
1,803.83	0.30	0.70
1,803.84	0.31	0.74
1,803.85	0.31	0.78
1,803.86	0.32	0.81
1,803.87	0.32	0.85
1,803.88	0.33	0.89
1,803.89	0.33	0.94
1,803.90	0.34	0.98
1,803.91	0.34	1.02
1,803.92	0.35	1.07
1,803.93	0.35	1.11
1,803.94	0.36	1.16
1,803.95	0.36	1.20
1,803.96	0.37	1.25
1,803.97	0.37	1.30
1,803.98	0.38	1.35
1,803.99	0.38	1.40
1,804.00	0.39	1.45
1,804.01	0.39	1.50
1,804.02	0.39	1.55
1,804.03	0.40	1.61
1,804.04	0.40	1.66
1,804.05	0.41	1.72
1,804.06	0.41	1.77
1,804.07	0.42	1.83
1,804.08	0.42	1.89
1,804.09	0.42	1.94
1,804.10	0.43	2.00
1,804.11	0.43	2.06
1,804.12	0.44	2.13
1,804.13	0.44	2.19
1,804.14	0.44	2.25
1,804.15	0.45	2.31
1,804.16	0.45	2.38
1,804.17	0.46	2.44
1,804.18	0.46	2.51
1,804.19	0.46	2.58
1,804.20	0.47	2.65
1,804.21	0.47	2.72
1,804.22	0.47	2.79
1,804.23	0.48	2.86
1,804.24	0.48	2.93
1,804.25	0.48	3.00
1,804.26	0.49	3.07
1,804.27	0.49	3.15
1,804.28	0.50	3.22
1,804.29	0.50	3.30
1,804.30	0.50	3.38
1,804.31	0.51	3.46
1,804.32	0.51	3.53
1,804.33	0.51	3.61
1,804.34	0.52	3.69
1,804.35	0.52	3.78
1,804.36	0.52	3.86
1,804.37	0.53	3.94
1,804.38	0.53	4.03
1,804.39	0.53	4.11
1,804.40	0.54	4.20
1,804.41	0.54	4.29
1,804.42	0.54	4.37
1,804.43	0.55	4.46
1,804.44	0.55	4.55
1,804.45	0.55	4.64
1,804.46	0.56	4.74
1,804.47	0.56	4.83
1,804.48	0.56	4.92
1,804.49	0.56	5.02
1,804.50	0.57	5.11
1,804.51	0.57	5.21
1,804.52	0.57	5.31
1,804.53	0.58	5.41
1,804.54	0.58	5.50
1,804.55	0.58	5.61
1,804.56	0.59	5.71
1,804.57	0.59	5.81
1,804.58	0.59	5.91
1,804.59	0.60	6.02
1,804.60	0.60	6.12
1,804.61	0.60	6.23
1,804.62	0.60	6.34
1,804.63	0.61	6.44
1,804.64	0.61	6.55
1,804.65	0.61	6.66
1,804.66	0.62	6.77
1,804.67	0.62	6.89
1,804.68	0.62	7.00
1,804.69	0.62	7.11
1,804.70	0.63	7.23
1,804.71	0.63	7.34
1,804.72	0.63	7.46
1,804.73	0.64	7.58
1,804.74	0.64	7.70
1,804.75	0.64	7.82
1,804.76	0.64	7.94
1,804.77	0.65	8.06
1,804.78	0.65	8.19
1,804.79	0.65	8.31
1,804.80	0.66	8.43
1,804.81	0.66	8.56
1,804.82	0.66	8.69
1,804.83	0.66	8.82
1,804.84	0.67	8.95
1,804.85	0.67	9.08
1,804.86	0.67	9.21
1,804.87	0.67	9.34
1,804.88	0.68	9.47
1,804.89	0.68	9.61
1,804.90	0.68	9.74
1,804.91	0.68	9.88
1,804.92	0.69	10.02
1,804.93	0.69	10.16
1,804.94	0.69	10.30
1,804.95	0.70	10.44
1,804.96	0.70	10.58
1,804.97	0.70	10.72
1,804.98	0.70	10.87
1,804.99	0.71	11.01
1,805.00	**0.71**	**11.16**

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **TS-CEC-3.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
No	Yes/No	Is the system lined?	
2.34	ac	A = Area draining to the practice	
0.06	ac	A_I = Impervious area draining to the practice	
16.3	minutes	T_c = Time of Concentration	
0.03	decimal	I = percent impervious area draining to the practice, in decimal form	
0.07	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.17	ac-in	WQV= 1" x Rv x A	
618	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.07	inches	Q = water quality depth. Q = WQV/A	
79	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
2.63	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.525	inches	Ia = initial abstraction. Ia = 0.2S	
210	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.06	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
100.00	feet	L = swale length [1]	← ≥ 100'
7.00	feet	w = bottom of the swale width[2]	← 0 - 8 feet [2]
1,821.30	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
1,822.50	feet	E_{BTM} = elevation of the bottom of the practice	← ≥ E_{SHWT}
3.0	:1	SS_{RIGHT} = right Side slope	← ≥3:1
3.0	:1	SS_{LEFT} = left Side slope	← ≥3:1
0.005	ft/ft	S = slope of swale in decimal form[3]	← 0.005 - .05
0.8	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← ≤ 4"
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.50	ft^2	Cross-sectional area check (assume trapezoidal channel)	
7.44	feet	Check wetted perimeter	
0.06	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
5%		Percent difference between WQF_{check} and WQF [5]	← +/- 10%
15	minutes	HRT = hydraulic residence time during the WQF	← ≥ 10 min
	ft	Peak elevation of the 10-year storm event	
	ft	Elevation of the top of the swale	
-	Yes/No	10 peak elevation ≤ the top of swale	← yes

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes: ESHWT > 27"

Summary for Subcatchment 11S: TS-CEC-3.0

Runoff = 1.28 cfs @ 12.27 hrs, Volume= 0.154 af, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.059	96	Gravel
	0.352	71	Meadow, non-grazed, HSG C
	1.376	55	Woods, Good, HSG B
	0.556	70	Woods, Good, HSG C
	2.343	62	Weighted Average
	2.343		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	100	0.0880	0.13		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
2.2	262	0.1530	1.96		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.7	247	0.0940	5.70	8.55	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
0.1	42	0.0190	7.26	8.90	**Pipe Channel, D** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
0.3	44	0.0110	2.86	10.74	**Trap/Vee/Rect Channel Flow, E** Bot.W=6.00' D=0.50' Z= 3.0 '/' Top.W=9.00' n= 0.030
16.3	695	Total			

Summary for Reach 12R: TS-CEC-3.0

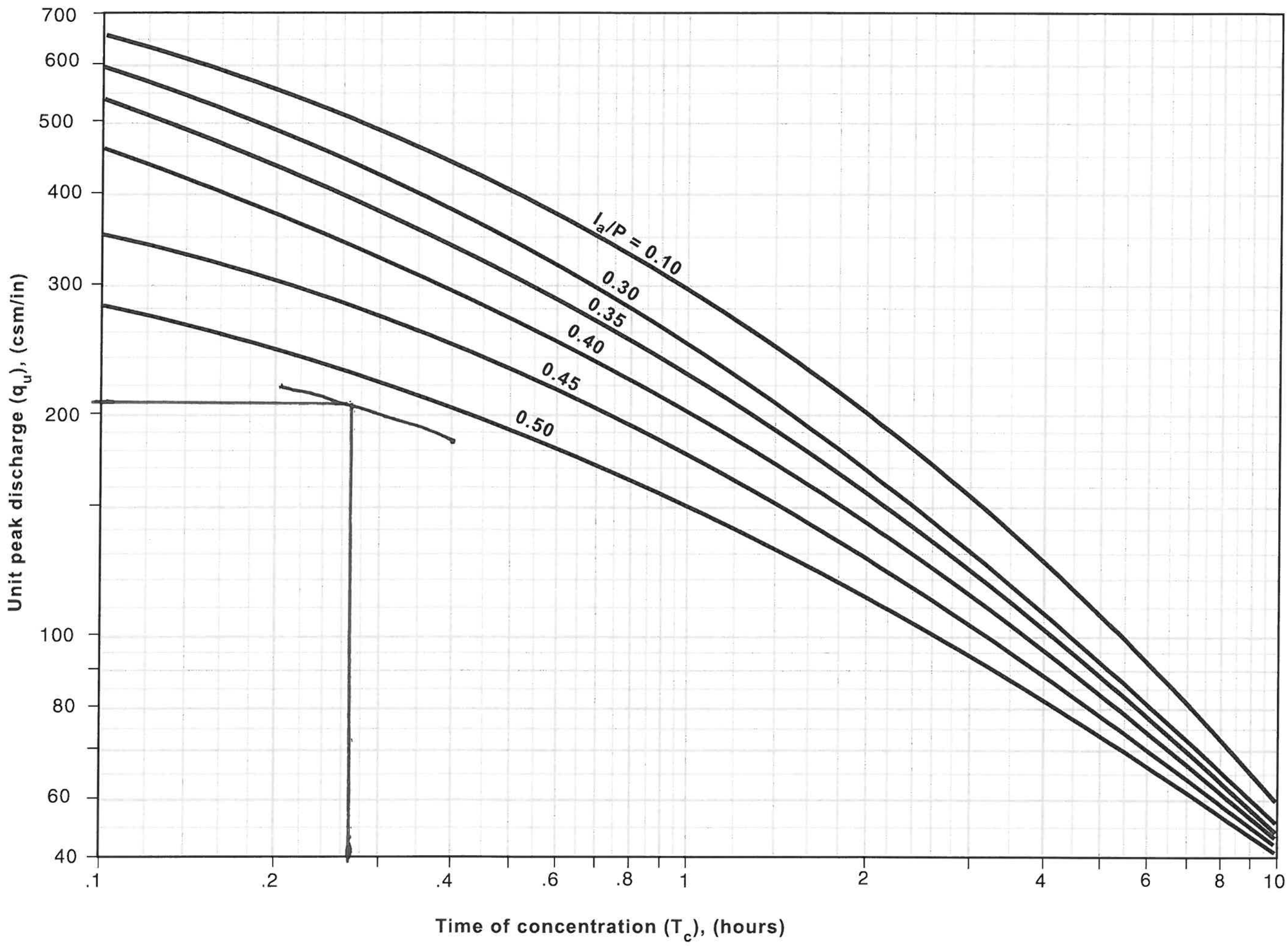
Inflow Area = 2.343 ac, 0.00% Impervious, Inflow Depth = 0.79" for 10 yr event
Inflow = 1.28 cfs @ 12.27 hrs, Volume= 0.154 af
Outflow = 1.21 cfs @ 12.42 hrs, Volume= 0.154 af, Atten= 5%, Lag= 9.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 0.35 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 0.12 fps, Avg. Travel Time= 14.2 min

Peak Storage= 343 cf @ 12.34 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 12.45 cfs

7.00' x 1.50' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 1,822.50', Outlet Invert= 1,822.00'

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TS - CEC-3.0

$$\frac{I_a}{P} = \frac{0.525"}{1"} = 0.525$$

$q_u = 210$

$$T_c = \frac{16.3 \text{ min}}{60} = 0.27 \text{ hr}$$

Stage-Discharge for Reach 12R: TS-CEC-3.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
1,822.50	0.00	0.00	1,823.03	0.41	1.84	1,823.56	0.60	6.45
1,822.51	0.03	0.00	1,823.04	0.41	1.91	1,823.57	0.60	6.56
1,822.52	0.05	0.01	1,823.05	0.41	1.97	1,823.58	0.60	6.67
1,822.53	0.07	0.01	1,823.06	0.42	2.03	1,823.59	0.61	6.79
1,822.54	0.08	0.02	1,823.07	0.42	2.10	1,823.60	0.61	6.91
1,822.55	0.09	0.03	1,823.08	0.43	2.16	1,823.61	0.61	7.02
1,822.56	0.11	0.05	1,823.09	0.43	2.23	1,823.62	0.62	7.14
1,822.57	0.12	0.06	1,823.10	0.43	2.30	1,823.63	0.62	7.26
1,822.58	0.13	0.07	1,823.11	0.44	2.36	1,823.64	0.62	7.38
1,822.59	0.14	0.09	1,823.12	0.44	2.43	1,823.65	0.62	7.51
1,822.60	0.15	0.11	1,823.13	0.45	2.50	1,823.66	0.63	7.63
1,822.61	0.16	0.13	1,823.14	0.45	2.58	1,823.67	0.63	7.75
1,822.62	0.16	0.15	1,823.15	0.46	2.65	1,823.68	0.63	7.88
1,822.63	0.17	0.17	1,823.16	0.46	2.72	1,823.69	0.64	8.01
1,822.64	0.18	0.19	1,823.17	0.46	2.79	1,823.70	0.64	8.13
1,822.65	0.19	0.21	1,823.18	0.47	2.87	1,823.71	0.64	8.26
1,822.66	0.20	0.24	1,823.19	0.47	2.95	1,823.72	0.65	8.39
1,822.67	0.20	0.26	1,823.20	0.47	3.02	1,823.73	0.65	8.52
1,822.68	0.21	0.29	1,823.21	0.48	3.10	1,823.74	0.65	8.65
1,822.69	0.22	0.32	1,823.22	0.48	3.18	1,823.75	0.65	8.78
1,822.70	0.23	0.34	1,823.23	0.49	3.26	1,823.76	0.66	8.92
1,822.71	0.23	0.37	1,823.24	0.49	3.34	1,823.77	0.66	9.05
1,822.72	0.24	0.41	1,823.25	0.49	3.42	1,823.78	0.66	9.19
1,822.73	0.25	0.44	1,823.26	0.50	3.50	1,823.79	0.67	9.33
1,822.74	0.25	0.47	1,823.27	0.50	3.59	1,823.80	0.67	9.46
1,822.75	0.26	0.50	1,823.28	0.50	3.67	1,823.81	0.67	9.60
1,822.76	0.27	0.54	1,823.29	0.51	3.76	1,823.82	0.67	9.74
1,822.77	0.27	0.57	1,823.30	0.51	3.85	1,823.83	0.68	9.88
1,822.78	0.28	0.61	1,823.31	0.51	3.93	1,823.84	0.68	10.03
1,822.79	0.28	0.65	1,823.32	0.52	4.02	1,823.85	0.68	10.17
1,822.80	0.29	0.69	1,823.33	0.52	4.11	1,823.86	0.68	10.31
1,822.81	0.30	0.73	1,823.34	0.53	4.20	1,823.87	0.69	10.46
1,822.82	0.30	0.77	1,823.35	0.53	4.29	1,823.88	0.69	10.61
1,822.83	0.31	0.81	1,823.36	0.53	4.39	1,823.89	0.69	10.75
1,822.84	0.31	0.85	1,823.37	0.54	4.48	1,823.90	0.70	10.90
1,822.85	0.32	0.90	1,823.38	0.54	4.57	1,823.91	0.70	11.05
1,822.86	0.32	0.94	1,823.39	0.54	4.67	1,823.92	0.70	11.20
1,822.87	0.33	0.99	1,823.40	0.55	4.77	1,823.93	0.70	11.36
1,822.88	0.33	1.03	1,823.41	0.55	4.86	1,823.94	0.71	11.51
1,822.89	0.34	1.08	1,823.42	0.55	4.96	1,823.95	0.71	11.66
1,822.90	0.34	1.13	1,823.43	0.56	5.06	1,823.96	0.71	11.82
1,822.91	0.35	1.18	1,823.44	0.56	5.16	1,823.97	0.71	11.98
1,822.92	0.35	1.23	1,823.45	0.56	5.26	1,823.98	0.72	12.14
1,822.93	0.36	1.28	1,823.46	0.57	5.37	1,823.99	0.72	12.29
1,822.94	0.36	1.33	1,823.47	0.57	5.47	1,824.00	**0.72**	**12.45**
1,822.95	0.37	1.38	1,823.48	0.57	5.57			
1,822.96	0.37	1.44	1,823.49	0.58	5.68			
1,822.97	0.38	1.49	1,823.50	0.58	5.79			
1,822.98	0.38	1.55	1,823.51	0.58	5.89			
1,822.99	0.39	1.61	1,823.52	0.58	6.00			
1,823.00	0.39	1.67	1,823.53	0.59	6.11			
1,823.01	0.40	1.72	1,823.54	0.59	6.22			
1,823.02	0.40	1.78	1,823.55	0.59	6.33			

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **TS-CEC-4.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Value	Unit	Description	Criteria
Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
No	Yes/No	Is the system lined?	
8.23	ac	A = Area draining to the practice	
0.12	ac	A_I = Impervious area draining to the practice	
18.3	minutes	T_c = Time of Concentration	
0.02	decimal	I = percent impervious area draining to the practice, in decimal form	
0.06	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.52	ac-in	WQV= 1" x Rv x A	
1,898	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.06	inches	Q = water quality depth. Q = WQV/A	
78	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
2.75	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.549	inches	Ia = initial abstraction. Ia = 0.2S	
180	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.15	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
100.00	feet	L = swale length [1]	← **≥ 100'**
6.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
1,838.10	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
1,840.00	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
1.6	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.86	ft^2	Cross-sectional area check (assume trapezoidal channel)	
6.85	feet	Check wetted perimeter	
0.15	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
4%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
10	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
1,841.39	ft	Peak elevation of the 10-year storm event	
1,841.50	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes: ESHWT = 26"

Summary for Subcatchment 13S: TS-CEC-4.0

Runoff = 9.71 cfs @ 12.27 hrs, Volume= 1.020 af, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
*	2,919	96	Gravel
*	2,483	96	Gravel
	16,030	71	Meadow, non-grazed, HSG C
	15,943	78	Meadow, non-grazed, HSG D
	150,935	70	Woods, Good, HSG C
	170,058	77	Woods, Good, HSG D
	358,368	74	Weighted Average
	358,368		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.2	100	0.0850	0.13		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
4.2	702	0.3090	2.78		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.8	208	0.0530	4.28	6.42	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
0.1	40	0.0500	11.77	14.44	**Pipe Channel, D** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
18.3	1,050	Total			

Summary for Reach 14R: TS-CEC-4.0

Inflow Area = 8.227 ac, 0.00% Impervious, Inflow Depth = 1.49" for 10 yr event
Inflow = 9.71 cfs @ 12.27 hrs, Volume= 1.020 af
Outflow = 9.51 cfs @ 12.34 hrs, Volume= 1.020 af, Atten= 2%, Lag= 4.6 min

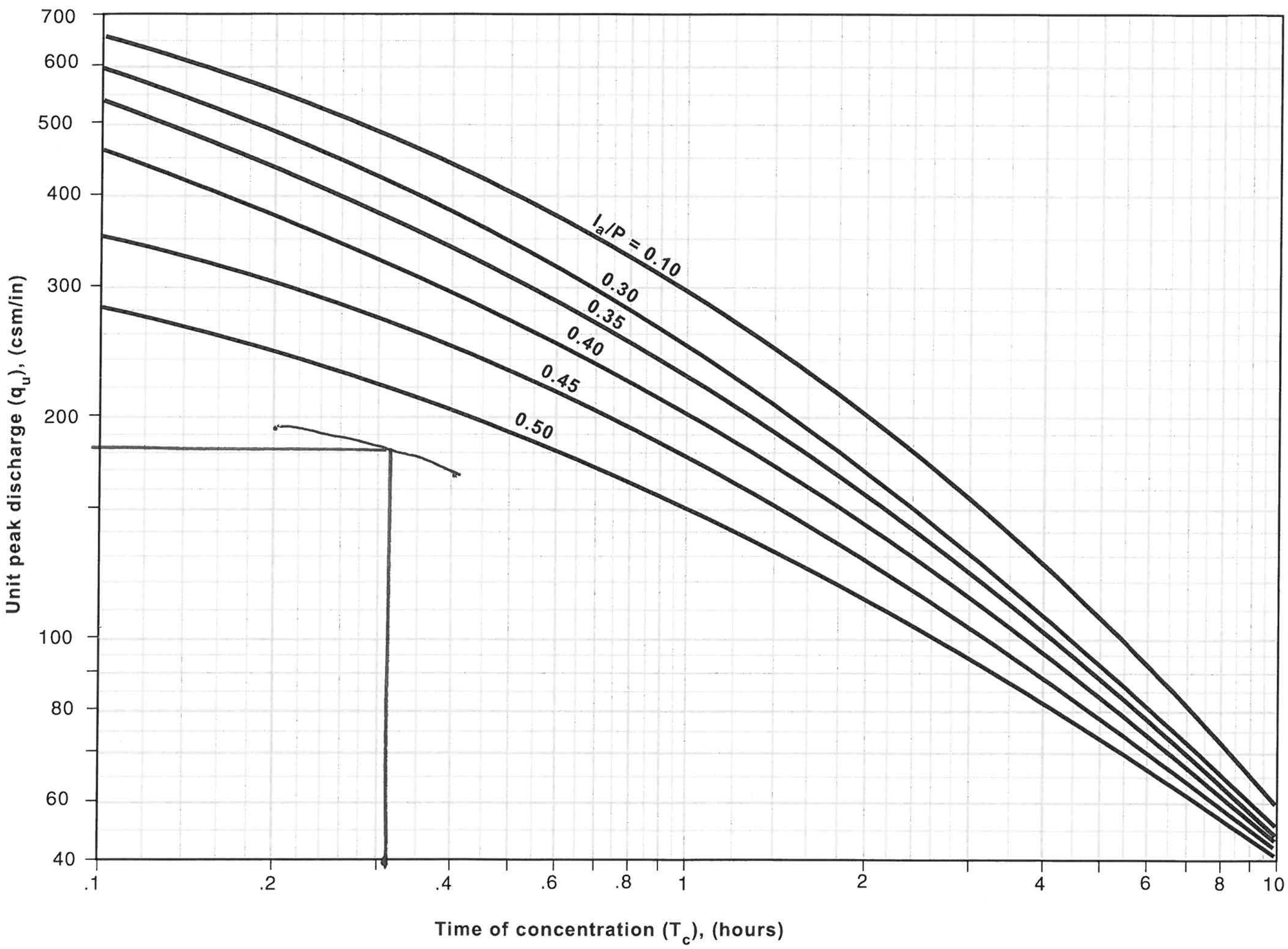
Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 0.68 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 0.21 fps, Avg. Travel Time= 7.8 min

Peak Storage= 1,409 cf @ 12.30 hrs
Average Depth at Peak Storage= 1.39'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.16 cfs

6.00' x 1.50' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 1,840.00', Outlet Invert= 1,839.50'

‡

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TS-CEC-4.0

$$\frac{I_a}{P} = \frac{0.549''}{1''} = 0.549$$

$q_u = 180$

$$T_c = \frac{18.3 \text{ min}}{60} = 0.305 \text{ hr}$$

Stage-Discharge for Reach 14R: TS-CEC-4.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
1,840.00	0.00	0.00	1,840.53	0.40	1.61	1,841.06	0.59	5.71
1,840.01	0.03	0.00	1,840.54	0.40	1.66	1,841.07	0.59	5.81
1,840.02	0.05	0.01	1,840.55	0.41	1.72	1,841.08	0.59	5.91
1,840.03	0.07	0.01	1,840.56	0.41	1.77	1,841.09	0.60	6.02
1,840.04	0.08	0.02	1,840.57	0.42	1.83	1,841.10	0.60	6.12
1,840.05	0.09	0.03	1,840.58	0.42	1.89	1,841.11	0.60	6.23
1,840.06	0.11	0.04	1,840.59	0.42	1.94	1,841.12	0.60	6.34
1,840.07	0.12	0.05	1,840.60	0.43	2.00	1,841.13	0.61	6.44
1,840.08	0.13	0.06	1,840.61	0.43	2.06	1,841.14	0.61	6.55
1,840.09	0.14	0.08	1,840.62	0.44	2.13	1,841.15	0.61	6.66
1,840.10	0.15	0.09	1,840.63	0.44	2.19	1,841.16	0.62	6.77
1,840.11	0.15	0.11	1,840.64	0.44	2.25	1,841.17	0.62	6.89
1,840.12	0.16	0.12	1,840.65	0.45	2.31	1,841.18	0.62	7.00
1,840.13	0.17	0.14	1,840.66	0.45	2.38	1,841.19	0.62	7.11
1,840.14	0.18	0.16	1,840.67	0.46	2.44	1,841.20	0.63	7.23
1,840.15	0.19	0.18	1,840.68	0.46	2.51	1,841.21	0.63	7.34
1,840.16	0.20	0.20	1,840.69	0.46	2.58	1,841.22	0.63	7.46
1,840.17	0.20	0.23	1,840.70	0.47	2.65	1,841.23	0.64	7.58
1,840.18	0.21	0.25	1,840.71	0.47	2.72	1,841.24	0.64	7.70
1,840.19	0.22	0.27	1,840.72	0.47	2.79	1,841.25	0.64	7.82
1,840.20	0.22	0.30	1,840.73	0.48	2.86	1,841.26	0.64	7.94
1,840.21	0.23	0.32	1,840.74	0.48	2.93	1,841.27	0.65	8.06
1,840.22	0.24	0.35	1,840.75	0.48	3.00	1,841.28	0.65	8.19
1,840.23	0.24	0.38	1,840.76	0.49	3.07	1,841.29	0.65	8.31
1,840.24	0.25	0.40	1,840.77	0.49	3.15	1,841.30	0.66	8.43
1,840.25	0.26	0.43	1,840.78	0.50	3.22	1,841.31	0.66	8.56
1,840.26	0.26	0.46	1,840.79	0.50	3.30	1,841.32	0.66	8.69
1,840.27	0.27	0.50	1,840.80	0.50	3.38	1,841.33	0.66	8.82
1,840.28	0.28	0.53	1,840.81	0.51	3.46	1,841.34	0.67	8.95
1,840.29	0.28	0.56	1,840.82	0.51	3.53	1,841.35	0.67	9.08
1,840.30	0.29	0.59	1,840.83	0.51	3.61	1,841.36	0.67	9.21
1,840.31	0.29	0.63	1,840.84	0.52	3.69	1,841.37	0.67	9.34
1,840.32	0.30	0.66	1,840.85	0.52	3.78	1,841.38	0.68	9.47
1,840.33	0.30	0.70	1,840.86	0.52	3.86	1,841.39	0.68	9.61
1,840.34	0.31	0.74	1,840.87	0.53	3.94	1,841.40	0.68	9.74
1,840.35	0.31	0.78	1,840.88	0.53	4.03	1,841.41	0.68	9.88
1,840.36	0.32	0.81	1,840.89	0.53	4.11	1,841.42	0.69	10.02
1,840.37	0.32	0.85	1,840.90	0.54	4.20	1,841.43	0.69	10.16
1,840.38	0.33	0.89	1,840.91	0.54	4.29	1,841.44	0.69	10.30
1,840.39	0.33	0.94	1,840.92	0.54	4.37	1,841.45	0.70	10.44
1,840.40	0.34	0.98	1,840.93	0.55	4.46	1,841.46	0.70	10.58
1,840.41	0.34	1.02	1,840.94	0.55	4.55	1,841.47	0.70	10.72
1,840.42	0.35	1.07	1,840.95	0.55	4.64	1,841.48	0.70	10.87
1,840.43	0.35	1.11	1,840.96	0.56	4.74	1,841.49	0.71	11.01
1,840.44	0.36	1.16	1,840.97	0.56	4.83	1,841.50	**0.71**	**11.16**
1,840.45	0.36	1.20	1,840.98	0.56	4.92			
1,840.46	0.37	1.25	1,840.99	0.56	5.02			
1,840.47	0.37	1.30	1,841.00	0.57	5.11			
1,840.48	0.38	1.35	1,841.01	0.57	5.21			
1,840.49	0.38	1.40	1,841.02	0.57	5.31			
1,840.50	0.39	1.45	1,841.03	0.58	5.41			
1,840.51	0.39	1.50	1,841.04	0.58	5.50			
1,840.52	0.39	1.55	1,841.05	0.58	5.61			

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **TS-CEC-5.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Value	Unit	Description	Criteria
Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
No	Yes/No	Is the system lined?	
5.24	ac	A = Area draining to the practice	
0.10	ac	A_I = Impervious area draining to the practice	
16.7	minutes	T_c = Time of Concentration	
0.02	decimal	I = percent impervious area draining to the practice, in decimal form	
0.07	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.35	ac-in	WQV= 1" x Rv x A	
1,271	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.07	inches	Q = water quality depth. Q = WQV/A	
79	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
2.70	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.540	inches	Ia = initial abstraction. Ia = 0.2S	
195	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.11	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
100.00	feet	L = swale length [1]	← **≥ 100'**
6.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
1,868.27	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
1,872.00	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
1.3	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.70	ft^2	Cross-sectional area check (assume trapezoidal channel)	
6.70	feet	Check wetted perimeter	
0.11	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
1%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
11	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
1,873.02	ft	Peak elevation of the 10-year storm event	
1,873.50	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes: ESHWT > 40"

Summary for Subcatchment 15S: TS-CEC-5.0

Runoff = 5.43 cfs @ 12.25 hrs, Volume= 0.564 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.086	96	Gravel
*	0.012	96	Gravel
	0.451	71	Meadow, non-grazed, HSG C
	0.066	78	Meadow, non-grazed, HSG D
	4.608	70	Woods, Good, HSG C
	0.017	77	Woods, Good, HSG D
	5.240	71	Weighted Average
	5.240		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.4	100	0.1560	0.16		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
4.9	710	0.2380	2.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
1.4	341	0.0510	4.20	6.30	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
0.0	42	0.1070	17.22	21.13	**Pipe Channel, D** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
16.7	1,193	Total			

Summary for Reach 16R: TS-CEC-5.0

Inflow Area = 5.240 ac, 0.00% Impervious, Inflow Depth = 1.29" for 10 yr event
Inflow = 5.43 cfs @ 12.25 hrs, Volume= 0.564 af
Outflow = 5.30 cfs @ 12.34 hrs, Volume= 0.564 af, Atten= 2%, Lag= 5.3 min

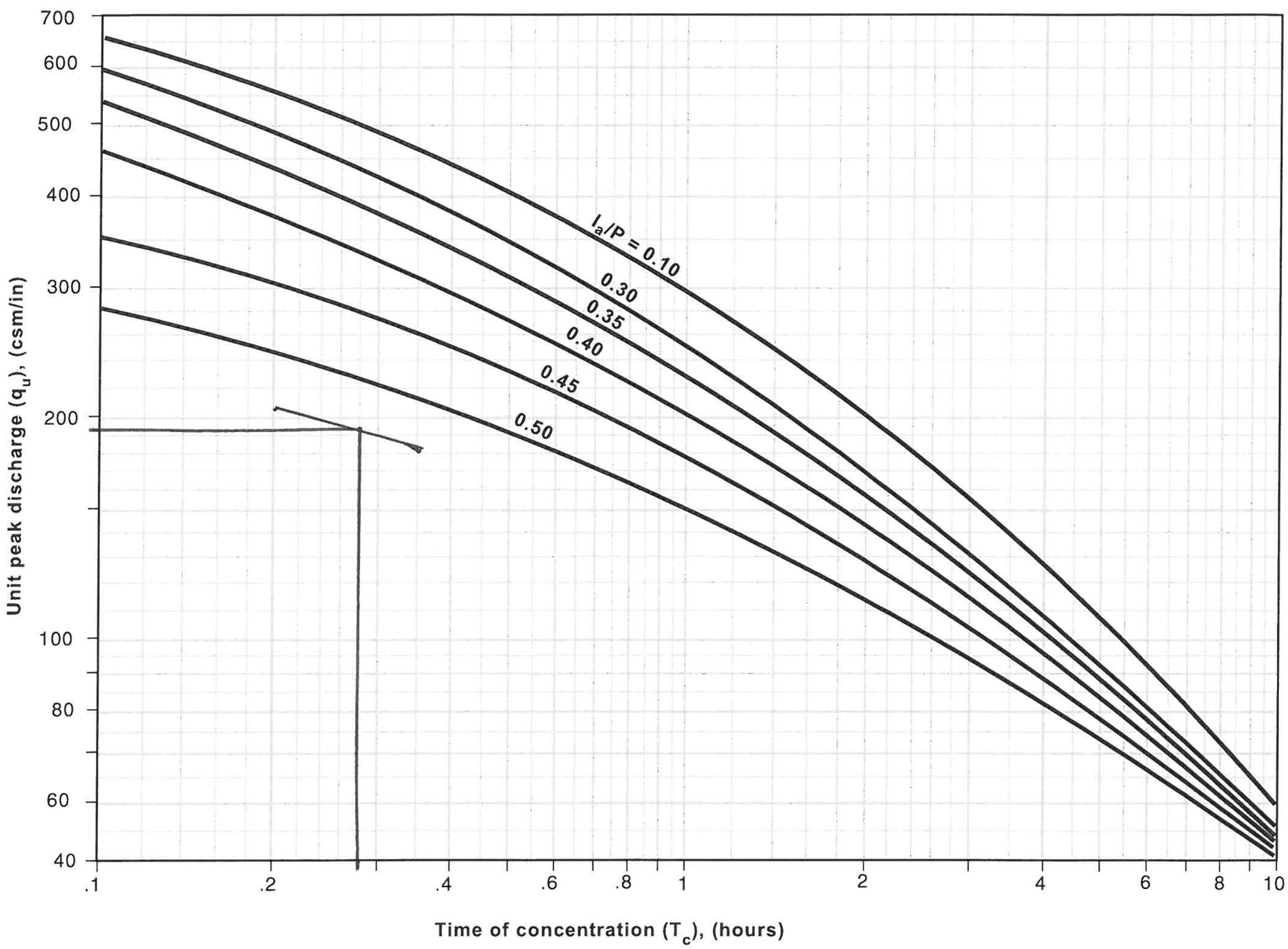
Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 0.57 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 0.18 fps, Avg. Travel Time= 9.3 min

Peak Storage= 924 cf @ 12.29 hrs
Average Depth at Peak Storage= 1.02'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 11.16 cfs

6.00' x 1.50' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 15.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 1,872.00', Outlet Invert= 1,871.50'

‡

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TS-CEC-5.0

$$\frac{I_a}{P} = \frac{0.540''}{1''} = 0.540$$

$q_u = 195$

$$T_c = \frac{16.7\,min}{60} = 0.28\ hr$$

Stage-Discharge for Reach 16R: TS-CEC-5.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
1,872.00	0.00	0.00
1,872.01	0.03	0.00
1,872.02	0.05	0.01
1,872.03	0.07	0.01
1,872.04	0.08	0.02
1,872.05	0.09	0.03
1,872.06	0.11	0.04
1,872.07	0.12	0.05
1,872.08	0.13	0.06
1,872.09	0.14	0.08
1,872.10	0.15	0.09
1,872.11	0.15	0.11
1,872.12	0.16	0.12
1,872.13	0.17	0.14
1,872.14	0.18	0.16
1,872.15	0.19	0.18
1,872.16	0.20	0.20
1,872.17	0.20	0.23
1,872.18	0.21	0.25
1,872.19	0.22	0.27
1,872.20	0.22	0.30
1,872.21	0.23	0.32
1,872.22	0.24	0.35
1,872.23	0.24	0.38
1,872.24	0.25	0.40
1,872.25	0.26	0.43
1,872.26	0.26	0.46
1,872.27	0.27	0.50
1,872.28	0.28	0.53
1,872.29	0.28	0.56
1,872.30	0.29	0.59
1,872.31	0.29	0.63
1,872.32	0.30	0.66
1,872.33	0.30	0.70
1,872.34	0.31	0.74
1,872.35	0.31	0.78
1,872.36	0.32	0.81
1,872.37	0.32	0.85
1,872.38	0.33	0.89
1,872.39	0.33	0.94
1,872.40	0.34	0.98
1,872.41	0.34	1.02
1,872.42	0.35	1.07
1,872.43	0.35	1.11
1,872.44	0.36	1.16
1,872.45	0.36	1.20
1,872.46	0.37	1.25
1,872.47	0.37	1.30
1,872.48	0.38	1.35
1,872.49	0.38	1.40
1,872.50	0.39	1.45
1,872.51	0.39	1.50
1,872.52	0.39	1.55
1,872.53	0.40	1.61
1,872.54	0.40	1.66
1,872.55	0.41	1.72
1,872.56	0.41	1.77
1,872.57	0.42	1.83
1,872.58	0.42	1.89
1,872.59	0.42	1.94
1,872.60	0.43	2.00
1,872.61	0.43	2.06
1,872.62	0.44	2.13
1,872.63	0.44	2.19
1,872.64	0.44	2.25
1,872.65	0.45	2.31
1,872.66	0.45	2.38
1,872.67	0.46	2.44
1,872.68	0.46	2.51
1,872.69	0.46	2.58
1,872.70	0.47	2.65
1,872.71	0.47	2.72
1,872.72	0.47	2.79
1,872.73	0.48	2.86
1,872.74	0.48	2.93
1,872.75	0.48	3.00
1,872.76	0.49	3.07
1,872.77	0.49	3.15
1,872.78	0.50	3.22
1,872.79	0.50	3.30
1,872.80	0.50	3.38
1,872.81	0.51	3.46
1,872.82	0.51	3.53
1,872.83	0.51	3.61
1,872.84	0.52	3.69
1,872.85	0.52	3.78
1,872.86	0.52	3.86
1,872.87	0.53	3.94
1,872.88	0.53	4.03
1,872.89	0.53	4.11
1,872.90	0.54	4.20
1,872.91	0.54	4.29
1,872.92	0.54	4.37
1,872.93	0.55	4.46
1,872.94	0.55	4.55
1,872.95	0.55	4.64
1,872.96	0.56	4.74
1,872.97	0.56	4.83
1,872.98	0.56	4.92
1,872.99	0.56	5.02
1,873.00	0.57	5.11
1,873.01	0.57	5.21
1,873.02	0.57	5.31
1,873.03	0.58	5.41
1,873.04	0.58	5.50
1,873.05	0.58	5.61
1,873.06	0.59	5.71
1,873.07	0.59	5.81
1,873.08	0.59	5.91
1,873.09	0.60	6.02
1,873.10	0.60	6.12
1,873.11	0.60	6.23
1,873.12	0.60	6.34
1,873.13	0.61	6.44
1,873.14	0.61	6.55
1,873.15	0.61	6.66
1,873.16	0.62	6.77
1,873.17	0.62	6.89
1,873.18	0.62	7.00
1,873.19	0.62	7.11
1,873.20	0.63	7.23
1,873.21	0.63	7.34
1,873.22	0.63	7.46
1,873.23	0.64	7.58
1,873.24	0.64	7.70
1,873.25	0.64	7.82
1,873.26	0.64	7.94
1,873.27	0.65	8.06
1,873.28	0.65	8.19
1,873.29	0.65	8.31
1,873.30	0.66	8.43
1,873.31	0.66	8.56
1,873.32	0.66	8.69
1,873.33	0.66	8.82
1,873.34	0.67	8.95
1,873.35	0.67	9.08
1,873.36	0.67	9.21
1,873.37	0.67	9.34
1,873.38	0.68	9.47
1,873.39	0.68	9.61
1,873.40	0.68	9.74
1,873.41	0.68	9.88
1,873.42	0.69	10.02
1,873.43	0.69	10.16
1,873.44	0.69	10.30
1,873.45	0.70	10.44
1,873.46	0.70	10.58
1,873.47	0.70	10.72
1,873.48	0.70	10.87
1,873.49	0.71	11.01
1,873.50	**0.71**	**11.16**

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **Wild Meadows ECA TS1.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?
no	Yes/No	Is the system lined?
0.36	ac	A = Area draining to the practice
0.02	ac	A_I = Impervious area draining to the practice
14.1	minutes	T_c = Time of Concentration
0.06	decimal	I = percent impervious area draining to the practice, in decimal form
0.10	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)
0.04	ac-in	WQV= 1" x Rv x A
131	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")
1	inches	P = amount of rainfall. For WQF in NH, P = 1".
0.10	inches	Q = water quality depth. Q = WQV/A
81	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)
2.33	inches	S = potential maximum retention. S = (1000/CN) - 10
0.465	inches	Ia = initial abstraction. Ia = 0.2S
270	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III
0.02	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac
100.00	feet	L = swale length [1] ← **≥ 100'**
5.00	feet	w = bottom of the swale width[2] ← **0 - 8 feet** [2]
2,156.00	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit
2,157.25	feet	E_{BTM} = elevation of the bottom of the practice ← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope ← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope ← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3] ← **0.005 - .05**
0.5	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4] ← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15
0.20	ft^2	Cross-sectional area check (assume trapezoidal channel)
5.25	feet	Check wetted perimeter
0.02	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**
8%		Percent difference between WQF_{check} and WQF [5] ← **+/- 10%**
22	minutes	HRT = hydraulic residence time during the WQF ← **≥ 10 min**
2,158.03	ft	Peak elevation of the 10-year storm event
2,159.25	ft	Elevation of the top of the swale
YES	Yes/No	10 peak elevation ≤ the top of swale ← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes:

Summary for Subcatchment ECATS1: ECA TS-1.0

Runoff = 0.42 cfs @ 12.20 hrs, Volume= 0.041 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.20	70	Woods, Good, HSG C
	0.14	71	Meadow, non-grazed, HSG C
*	0.02	96	Gravel
	0.36	72	Weighted Average
	0.36		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	100	0.0800	0.12		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
0.0	10	0.5000	3.54		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.5	175	0.0514	6.11	24.44	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040 Mountain streams
14.1	285	Total			

Summary for Reach 13R: ECA TS-1.0

Inflow Area = 0.36 ac, 0.00% Impervious, Inflow Depth = 1.36" for 10 yr event
Inflow = 0.42 cfs @ 12.20 hrs, Volume= 0.041 af
Outflow = 0.38 cfs @ 12.28 hrs, Volume= 0.041 af, Atten= 10%, Lag= 4.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.26 fps, Min. Travel Time= 6.5 min
Avg. Velocity = 0.08 fps, Avg. Travel Time= 19.7 min

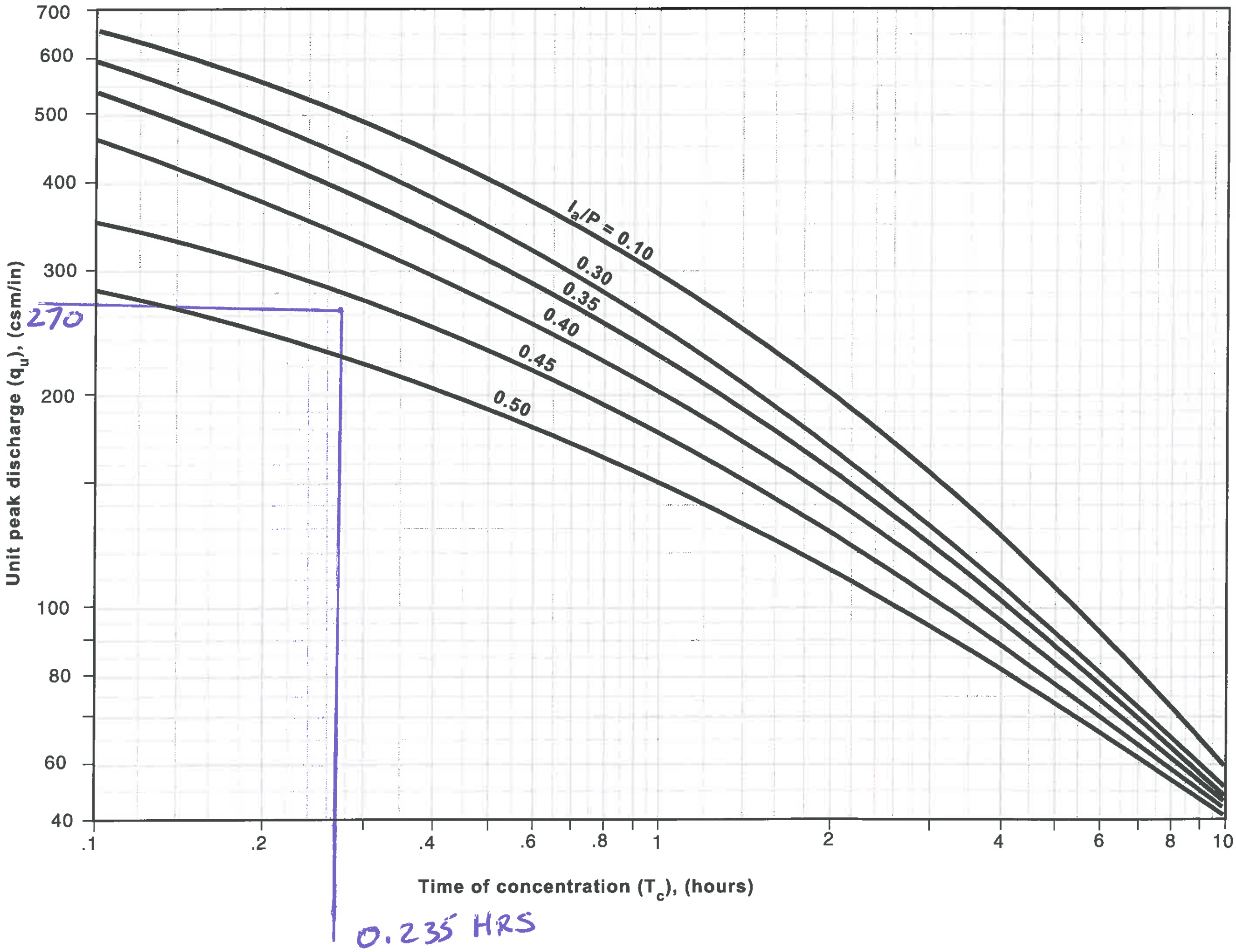
Peak Storage= 147 cf @ 12.28 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 17.85 cfs

5.00' x 2.00' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 17.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 2,158.25', Outlet Invert= 2,157.75'

‡

TS-ECA-1.0

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



Stage-Discharge for Reach 13R: ECA TS-1.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
2,158.25	0.00	0.00	2,158.77	0.39	1.32
2,158.26	0.03	0.00	2,158.78	0.39	1.37
2,158.27	0.05	0.01	2,158.79	0.40	1.42
2,158.28	0.07	0.01	2,158.80	0.40	1.46
2,158.29	0.08	0.02	2,158.81	0.40	1.51
2,158.30	0.09	0.02	2,158.82	0.41	1.56
2,158.31	0.10	0.03	2,158.83	0.41	1.61
2,158.32	0.12	0.04	2,158.84	0.42	1.66
2,158.33	0.13	0.05	2,158.85	0.42	1.71
2,158.34	0.14	0.06	2,158.86	0.42	1.77
2,158.35	0.14	0.08	2,158.87	0.43	1.82
2,158.36	0.15	0.09	2,158.88	0.43	1.87
2,158.37	0.16	0.10	2,158.89	0.44	1.93
2,158.38	0.17	0.12	2,158.90	0.44	1.98
2,158.39	0.18	0.14	2,158.91	0.44	2.04
2,158.40	0.19	0.15	2,158.92	0.45	2.10
2,158.41	0.19	0.17	2,158.93	0.45	2.15
2,158.42	0.20	0.19	2,158.94	0.45	2.21
2,158.43	0.21	0.21	2,158.95	0.46	2.27
2,158.44	0.22	0.23	2,158.96	0.46	2.33
2,158.45	0.22	0.25	2,158.97	0.46	2.39
2,158.46	0.23	0.27	2,158.98	0.47	2.46
2,158.47	0.24	0.29	2,158.99	0.47	2.52
2,158.48	0.24	0.32	2,159.00	0.47	2.58
2,158.49	0.25	0.34	2,159.01	0.48	2.65
2,158.50	0.25	0.37	2,159.02	0.48	2.71
2,158.51	0.26	0.39	2,159.03	0.49	2.78
2,158.52	0.27	0.42	2,159.04	0.49	2.84
2,158.53	0.27	0.44	2,159.05	0.49	2.91
2,158.54	0.28	0.47	2,159.06	0.50	2.98
2,158.55	0.28	0.50	2,159.07	0.50	3.05
2,158.56	0.29	0.53	2,159.08	0.50	3.12
2,158.57	0.29	0.56	2,159.09	0.51	3.19
2,158.58	0.30	0.59	2,159.10	0.51	3.26
2,158.59	0.30	0.62	2,159.11	0.51	3.34
2,158.60	0.31	0.66	2,159.12	0.52	3.41
2,158.61	0.31	0.69	2,159.13	0.52	3.48
2,158.62	0.32	0.72	2,159.14	0.52	3.56
2,158.63	0.32	0.76	2,159.15	0.52	3.64
2,158.64	0.33	0.79	2,159.16	0.53	3.71
2,158.65	0.33	0.83	2,159.17	0.53	3.79
2,158.66	0.34	0.87	2,159.18	0.53	3.87
2,158.67	0.34	0.90	2,159.19	0.54	3.95
2,158.68	0.35	0.94	2,159.20	0.54	4.03
2,158.69	0.35	0.98	2,159.21	0.54	4.11
2,158.70	0.36	1.02	2,159.22	0.55	4.19
2,158.71	0.36	1.06	2,159.23	0.55	4.28
2,158.72	0.37	1.10	2,159.24	0.55	4.36
2,158.73	0.37	1.15	2,159.25	**0.56**	**4.45**
2,158.74	0.37	1.19			
2,158.75	0.38	1.23			
2,158.76	0.38	1.28			

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **Wild Meadows ECA TS2.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
no	Yes/No	Is the system lined?	
0.63	ac	A = Area draining to the practice	
0.06	ac	A_I = Impervious area draining to the practice	
15.2	minutes	T_c = Time of Concentration	
0.10	decimal	I = percent impervious area draining to the practice, in decimal form	
0.14	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.09	ac-in	WQV= 1" x Rv x A	
310	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.14	inches	Q = water quality depth. Q = WQV/A	
83	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
2.02	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.404	inches	Ia = initial abstraction. Ia = 0.2S	
325	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.04	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
100.00	feet	L = swale length [1]	← **≥ 100'**
5.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
2,112.83	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
2,115.00	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
0.8	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.36	ft^2	Cross-sectional area check (assume trapezoidal channel)	
5.44	feet	Check wetted perimeter	
0.04	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
-3%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
14	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
2,115.37	ft	Peak elevation of the 10-year storm event	
2,116.50	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes:

Summary for Subcatchment ECATS2: ECA TS-2.0

Runoff = 0.76 cfs @ 12.22 hrs, Volume= 0.075 af, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.37	70	Woods, Good, HSG C
	0.20	71	Meadow, non-grazed, HSG C
*	0.06	96	Gravel
	0.63	73	Weighted Average
	0.63		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	100	0.0700	0.12		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
0.9	333	0.0570	6.44	25.74	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040 Mountain streams
15.2	433	Total			

Summary for Reach 14R: ECA TS-2.0

Inflow Area = 0.63 ac, 0.00% Impervious, Inflow Depth = 1.42" for 10 yr event
Inflow = 0.76 cfs @ 12.22 hrs, Volume= 0.075 af
Outflow = 0.71 cfs @ 12.28 hrs, Volume= 0.075 af, Atten= 7%, Lag= 4.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.32 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 0.10 fps, Avg. Travel Time= 16.5 min

Peak Storage= 223 cf @ 12.28 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 2.00', Capacity at Bank-Full= 17.85 cfs

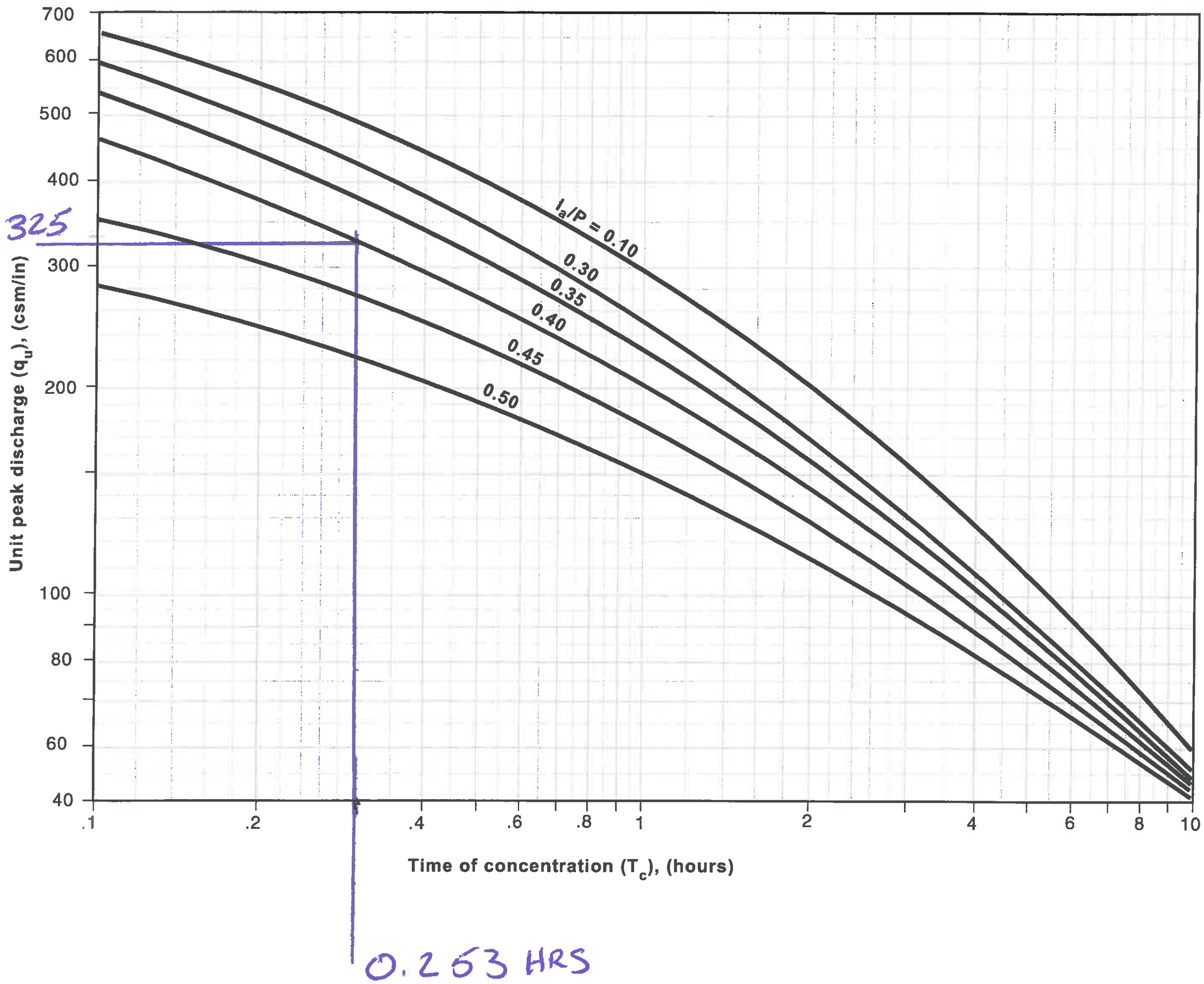
5.00' x 2.00' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 17.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 2,115.50', Outlet Invert= 2,115.00'

Stage-Discharge for Reach 14R: ECA TS-2.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)	Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
2,115.50	0.00	0.00	2,116.02	0.39	1.32	2,116.54	0.57	4.79
2,115.51	0.03	0.00	2,116.03	0.39	1.37	2,116.55	0.57	4.88
2,115.52	0.05	0.01	2,116.04	0.40	1.42	2,116.56	0.57	4.97
2,115.53	0.07	0.01	2,116.05	0.40	1.46	2,116.57	0.58	5.06
2,115.54	0.08	0.02	2,116.06	0.40	1.51	2,116.58	0.58	5.16
2,115.55	0.09	0.02	2,116.07	0.41	1.56	2,116.59	0.58	5.25
2,115.56	0.10	0.03	2,116.08	0.41	1.61	2,116.60	0.59	5.34
2,115.57	0.12	0.04	2,116.09	0.42	1.66	2,116.61	0.59	5.44
2,115.58	0.13	0.05	2,116.10	0.42	1.71	2,116.62	0.59	5.53
2,115.59	0.14	0.06	2,116.11	0.42	1.77	2,116.63	0.59	5.63
2,115.60	0.14	0.08	2,116.12	0.43	1.82	2,116.64	0.60	5.73
2,115.61	0.15	0.09	2,116.13	0.43	1.87	2,116.65	0.60	5.83
2,115.62	0.16	0.10	2,116.14	0.44	1.93	2,116.66	0.60	5.93
2,115.63	0.17	0.12	2,116.15	0.44	1.98	2,116.67	0.61	6.03
2,115.64	0.18	0.14	2,116.16	0.44	2.04	2,116.68	0.61	6.13
2,115.65	0.19	0.15	2,116.17	0.45	2.10	2,116.69	0.61	6.23
2,115.66	0.19	0.17	2,116.18	0.45	2.15	2,116.70	0.61	6.33
2,115.67	0.20	0.19	2,116.19	0.45	2.21	2,116.71	0.62	6.44
2,115.68	0.21	0.21	2,116.20	0.46	2.27	2,116.72	0.62	6.54
2,115.69	0.22	0.23	2,116.21	0.46	2.33	2,116.73	0.62	6.65
2,115.70	0.22	0.25	2,116.22	0.46	2.39	2,116.74	0.62	6.75
2,115.71	0.23	0.27	2,116.23	0.47	2.46	2,116.75	0.63	6.86
2,115.72	0.24	0.29	2,116.24	0.47	2.52	2,116.76	0.63	6.97
2,115.73	0.24	0.32	2,116.25	0.47	2.58	2,116.77	0.63	7.08
2,115.74	0.25	0.34	2,116.26	0.48	2.65	2,116.78	0.64	7.19
2,115.75	0.25	0.37	2,116.27	0.48	2.71	2,116.79	0.64	7.30
2,115.76	0.26	0.39	2,116.28	0.49	2.78	2,116.80	0.64	7.41
2,115.77	0.27	0.42	2,116.29	0.49	2.84	2,116.81	0.64	7.53
2,115.78	0.27	0.44	2,116.30	0.49	2.91	2,116.82	0.65	7.64
2,115.79	0.28	0.47	2,116.31	0.50	2.98	2,116.83	0.65	7.76
2,115.80	0.28	0.50	2,116.32	0.50	3.05	2,116.84	0.65	7.87
2,115.81	0.29	0.53	2,116.33	0.50	3.12	2,116.85	0.65	7.99
2,115.82	0.29	0.56	2,116.34	0.51	3.19	2,116.86	0.66	8.11
2,115.83	0.30	0.59	2,116.35	0.51	3.26	2,116.87	0.66	8.23
2,115.84	0.30	0.62	2,116.36	0.51	3.34	2,116.88	0.66	8.35
2,115.85	0.31	0.66	2,116.37	0.52	3.41	2,116.89	0.66	8.47
2,115.86	0.31	0.69	2,116.38	0.52	3.48	2,116.90	0.67	8.59
2,115.87	0.32	0.72	2,116.39	0.52	3.56	2,116.91	0.67	8.72
2,115.88	0.32	0.76	2,116.40	0.52	3.64	2,116.92	0.67	8.84
2,115.89	0.33	0.79	2,116.41	0.53	3.71	2,116.93	0.68	8.97
2,115.90	0.33	0.83	2,116.42	0.53	3.79	2,116.94	0.68	9.09
2,115.91	0.34	0.87	2,116.43	0.53	3.87	2,116.95	0.68	9.22
2,115.92	0.34	0.90	2,116.44	0.54	3.95	2,116.96	0.68	9.35
2,115.93	0.35	0.94	2,116.45	0.54	4.03	2,116.97	0.69	9.48
2,115.94	0.35	0.98	2,116.46	0.54	4.11	2,116.98	0.69	9.61
2,115.95	0.36	1.02	2,116.47	0.55	4.19	2,116.99	0.69	9.74
2,115.96	0.36	1.06	2,116.48	0.55	4.28	2,117.00	0.69	9.87
2,115.97	0.37	1.10	2,116.49	0.55	4.36	2,117.01	0.70	10.01
2,115.98	0.37	1.15	2,116.50	0.56	4.45	2,117.02	0.70	10.14
2,115.99	0.37	1.19	2,116.51	0.56	4.53	2,117.03	0.70	10.28
2,116.00	0.38	1.23	2,116.52	0.56	4.62	2,117.04	0.70	10.41
2,116.01	0.38	1.28	2,116.53	0.56	4.71	2,117.05	0.71	10.55

TS-ECA-2.0

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **Wild Meadows ECA TS3.0**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Value	Unit	Description	Criteria
Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
no	Yes/No	Is the system lined?	
0.68	ac	A = Area draining to the practice	
0.07	ac	A_I = Impervious area draining to the practice	
13.6	minutes	T_c = Time of Concentration	
0.10	decimal	I = percent impervious area draining to the practice, in decimal form	
0.14	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.10	ac-in	WQV= 1" x Rv x A	
352	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.14	inches	Q = water quality depth. Q = WQV/A	
84	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
1.97	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.394	inches	Ia = initial abstraction. Ia = 0.2S	
350	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.05	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
100.00	feet	L = swale length [1]	← **≥ 100'**
5.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
2,053.00	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
2,054.00	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.005	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
1.0	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.42	ft^2	Cross-sectional area check (assume trapezoidal channel)	
5.51	feet	Check wetted perimeter	
0.05	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
0%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
13	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
2,054.39	ft	Peak elevation of the 10-year storm event	
2,055.00	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

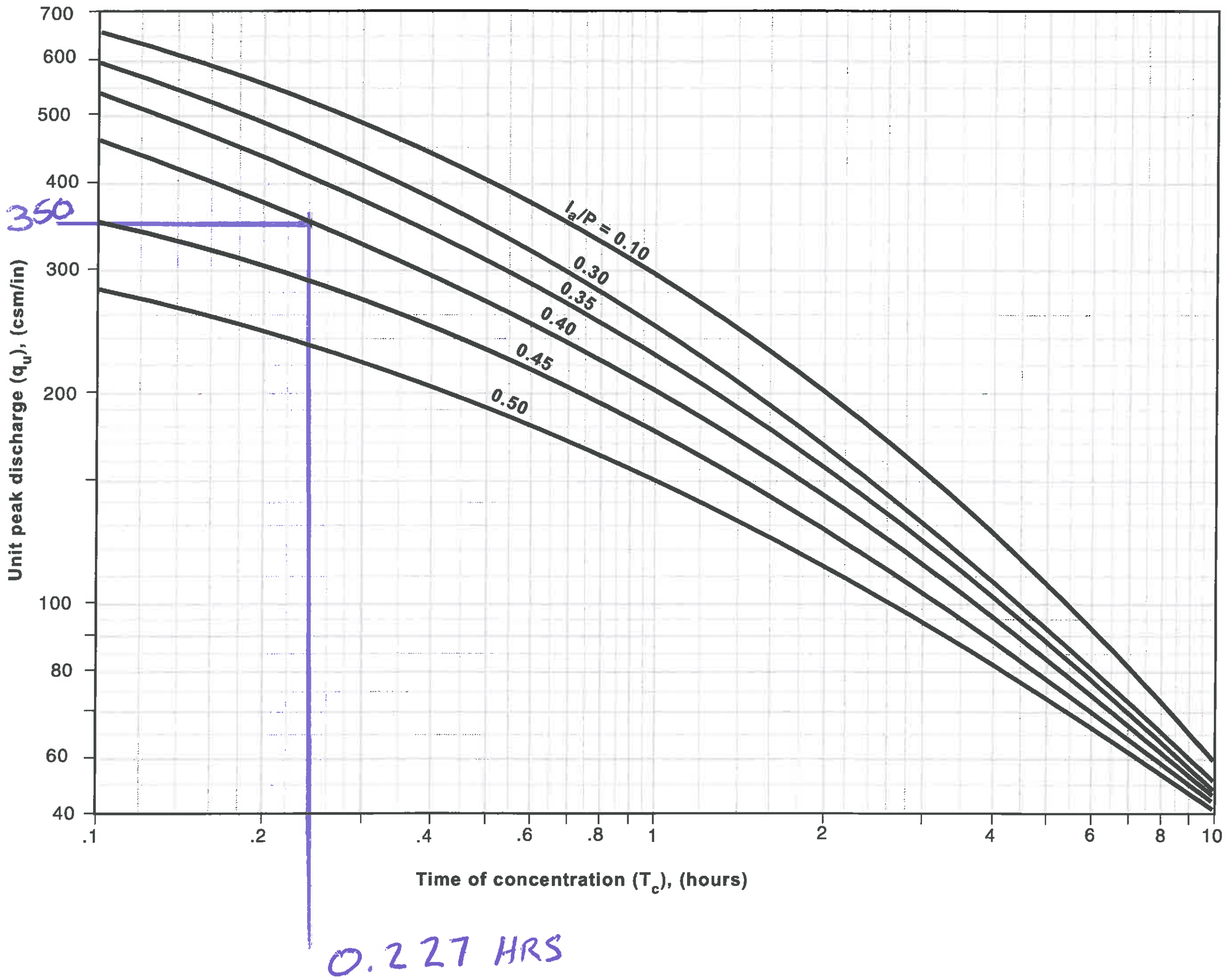
Designer's Notes:

Stage-Discharge for Reach 9R: ECA TS-3.0

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
2,054.50	0.00	0.00
2,054.51	0.03	0.00
2,054.52	0.05	0.01
2,054.53	0.07	0.01
2,054.54	0.08	0.02
2,054.55	0.09	0.02
2,054.56	0.10	0.03
2,054.57	0.12	0.04
2,054.58	0.13	0.05
2,054.59	0.14	0.06
2,054.60	0.14	0.08
2,054.61	0.15	0.09
2,054.62	0.16	0.10
2,054.63	0.17	0.12
2,054.64	0.18	0.14
2,054.65	0.19	0.15
2,054.66	0.19	0.17
2,054.67	0.20	0.19
2,054.68	0.21	0.21
2,054.69	0.22	0.23
2,054.70	0.22	0.25
2,054.71	0.23	0.27
2,054.72	0.24	0.29
2,054.73	0.24	0.32
2,054.74	0.25	0.34
2,054.75	0.25	0.37
2,054.76	0.26	0.39
2,054.77	0.27	0.42
2,054.78	0.27	0.44
2,054.79	0.28	0.47
2,054.80	0.28	0.50
2,054.81	0.29	0.53
2,054.82	0.29	0.56
2,054.83	0.30	0.59
2,054.84	0.30	0.62
2,054.85	0.31	0.66
2,054.86	0.31	0.69
2,054.87	0.32	0.72
2,054.88	0.32	0.76
2,054.89	0.33	0.79
2,054.90	0.33	0.83
2,054.91	0.34	0.87
2,054.92	0.34	0.90
2,054.93	0.35	0.94
2,054.94	0.35	0.98
2,054.95	0.36	1.02
2,054.96	0.36	1.06
2,054.97	0.37	1.10
2,054.98	0.37	1.15
2,054.99	0.37	1.19
2,055.00	0.38	1.23
2,055.01	0.38	1.28
2,055.02	0.39	1.32
2,055.03	0.39	1.37
2,055.04	0.40	1.42
2,055.05	0.40	1.46
2,055.06	0.40	1.51
2,055.07	0.41	1.56
2,055.08	0.41	1.61
2,055.09	0.42	1.66
2,055.10	0.42	1.71
2,055.11	0.42	1.77
2,055.12	0.43	1.82
2,055.13	0.43	1.87
2,055.14	0.44	1.93
2,055.15	0.44	1.98
2,055.16	0.44	2.04
2,055.17	0.45	2.10
2,055.18	0.45	2.15
2,055.19	0.45	2.21
2,055.20	0.46	2.27
2,055.21	0.46	2.33
2,055.22	0.46	2.39
2,055.23	0.47	2.46
2,055.24	0.47	2.52
2,055.25	0.47	2.58
2,055.26	0.48	2.65
2,055.27	0.48	2.71
2,055.28	0.49	2.78
2,055.29	0.49	2.84
2,055.30	0.49	2.91
2,055.31	0.50	2.98
2,055.32	0.50	3.05
2,055.33	0.50	3.12
2,055.34	0.51	3.19
2,055.35	0.51	3.26
2,055.36	0.51	3.34
2,055.37	0.52	3.41
2,055.38	0.52	3.48
2,055.39	0.52	3.56
2,055.40	0.52	3.64
2,055.41	0.53	3.71
2,055.42	0.53	3.79
2,055.43	0.53	3.87
2,055.44	0.54	3.95
2,055.45	0.54	4.03
2,055.46	0.54	4.11
2,055.47	0.55	4.19
2,055.48	0.55	4.28
2,055.49	0.55	4.36
2,055.50	0.56	4.45
2,055.51	0.56	4.53
2,055.52	0.56	4.62
2,055.53	0.56	4.71
2,055.54	0.57	4.79
2,055.55	0.57	4.88
2,055.56	0.57	4.97
2,055.57	0.58	5.06
2,055.58	0.58	5.16
2,055.59	0.58	5.25
2,055.60	0.59	5.34
2,055.61	0.59	5.44
2,055.62	0.59	5.53
2,055.63	0.59	5.63
2,055.64	0.60	5.73
2,055.65	0.60	5.83
2,055.66	0.60	5.93
2,055.67	0.61	6.03
2,055.68	0.61	6.13
2,055.69	0.61	6.23
2,055.70	0.61	6.33
2,055.71	0.62	6.44
2,055.72	0.62	6.54
2,055.73	0.62	6.65
2,055.74	0.62	6.75
2,055.75	0.63	6.86
2,055.76	0.63	6.97
2,055.77	0.63	7.08
2,055.78	0.64	7.19
2,055.79	0.64	7.30
2,055.80	0.64	7.42
2,055.81	0.64	7.53
2,055.82	0.65	7.64
2,055.83	0.65	7.76
2,055.84	0.65	7.88
2,055.85	0.65	7.99
2,055.86	0.66	8.11
2,055.87	0.66	8.23
2,055.88	0.66	8.35
2,055.89	0.66	8.47
2,055.90	0.67	8.59
2,055.91	0.67	8.72
2,055.92	0.67	8.84
2,055.93	0.68	8.97
2,055.94	0.68	9.09
2,055.95	0.68	9.22
2,055.96	0.68	9.35
2,055.97	0.69	9.48
2,055.98	0.69	9.61
2,055.99	0.69	9.74
2,056.00	**0.69**	**9.87**

ECA-TS-3.0

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution



Summary for Subcatchment ECATS3: ECA TS-3.0

Runoff = 0.86 cfs @ 12.20 hrs, Volume= 0.081 af, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.39	70	Woods, Good, HSG C
	0.22	71	Meadow, non-grazed, HSG C
*	0.07	96	Gravel
	0.68	73	Weighted Average
	0.68		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.1200	0.14		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
1.2	125	0.1200	1.73		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.9	333	0.0570	6.44	25.74	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040 Mountain streams
13.6	558	Total			

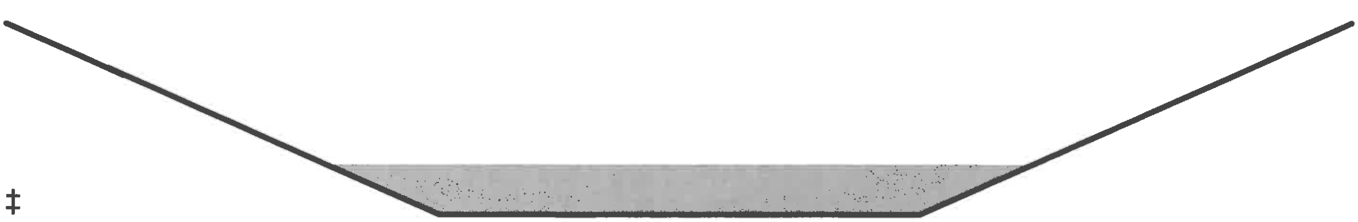
Summary for Reach 9R: ECA TS-3.0

Inflow Area = 0.68 ac, 0.00% Impervious, Inflow Depth = 1.42" for 10 yr event
Inflow = 0.86 cfs @ 12.20 hrs, Volume= 0.081 af
Outflow = 0.79 cfs @ 12.26 hrs, Volume= 0.081 af, Atten= 8%, Lag= 3.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.33 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 0.10 fps, Avg. Travel Time= 16.8 min

Peak Storage= 240 cf @ 12.26 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 9.87 cfs

5.00' x 1.50' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 14.00'
Length= 100.0' Slope= 0.0050 '/'
Inlet Invert= 2,054.50', Outlet Invert= 2,054.00'



‡

B. Substation Interconnection Station

FILTRATION PRACTICE DESIGN CRITERIA (Env-Wq 1508.06)

Type/Node Name: **Surface Filtration Pond INF1**

Enter the type of filtration practice (e.g., bioretention system) and the node name in the drainage analysis, if applicable

Yes		Have you reviewed the restrictions on unlined systems outlined in Env-Wq 1508.06(b)?	
1.05	ac	A = Area draining to the practice[1]	
0.73	ac	A_I = Impervious area draining to the practice	
0.70	decimal	I = percent impervious area draining to the practice, in decimal form	
0.68	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.71	ac-in	WQV= 1" x Rv x A	
2,575	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
644	cf	25% x WQV (check calc for sediment forebay volume)	
1,932	cf	75% x WQV (check calc for surface sand filter volume)	
Forebay		Method of Pretreatment? (not required for clean or roof runoff)	
1,341	cf	V_{SED} = sediment forebay volume, if used for pretreatment	← **$\geq$ 25%WQV**
2,588	sf	A_{SA} = surface area of the practice	
2.50	iph	I_{DESIGN} = design infiltration rate[2]	
No	Yes/No	If I_{DESIGN} is < 0.50 iph, has an underdrain been provided?	
4.8	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	← **$\leq$ 72-hrs**
630.92	feet	E_{FC} = elevation of the bottom of the filter course material	
NA	feet	E_{UD} = invert elevation of the underdrain (UD), if applicable	
630.67	feet	E_{BTM} = elevation of the bottom of the practice (i.e., bottom of the stone reservoir).	
629.50	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
629.50	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
#VALUE!	feet	$D_{FC\ to\ UD}$ = depth to UD from the bottom of the filter course[3]	← **$\geq$ 1'**
1.42	feet	$D_{FC\ to\ ROCK}$ = depth to bedrock from the bottom of the filter course[3]	← **$\geq$ 1'**
1.42	feet	$D_{FC\ to\ SHWT}$ = depth to SHWT from the bottom of the filter course[3]	← **$\geq$ 1'**
1.17	feet	$D_{BTM\ to\ SHWT}$ = depth to SHWT from the bottom of the practice[3]	← **$\geq$ 2'**
633.50	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
636.50	ft	Elevation of the top of the practice	
YES		10 peak elevation $\leq$ Elevation of the top of the practice	← **yes**

If a surface sand filter is proposed:

YES	ac	Drainage Area check.	← **< 10 ac**
2,922	cf	V = volume of storage[4, 5] (attach a stage-storage table)	← **$\geq$ 75%WQV**
18.0	inches	D_{FC} = filter course thickness	← **18"**
Sheet	D1.4	Note what sheet in the plan set contains the filter course specification	
no*	Yes/No	Access grate provided?	← **yes**
Gravel		The filter shall not be covered in grass. What is covering the filter?	

If an underground sand filter is proposed:

YES	ac	Drainage Area check.	← **< 10 ac**
	cf	V = volume of storage[4, 5] (attach a stage-storage table)	← **$\geq$ 75%WQV**
	inches	D_{FC} = filter course thickness	← **24"**
Sheet		Note what sheet in the plan set contains the filter course specification	
	Yes/No	Access grate provided?	← **yes**

If a bioretention area is proposed:

YES	ac	Drainage Area no larger than 5 ac?	← **yes**
	cf	V = volume of storage[4, 5] (attach a stage-storage table)	← **≥ WQV**
	inches	D_{FC} = filter course thickness	← **18"**
Sheet		Note what sheet in the plan set contains the filter course specification	
	:1	Pond side slopes	← **≥2:1**
Sheet		Note what sheet in the plan set contains the planting plans and surface cover	

If porous pavement is proposed:

		Type of pavement proposed (concrete? Asphalt? Pavers? Etc)	
	acres	A_{SA} = surface area of the pervious pavement	
-	:1	ratio of the contributing area to the pervious surface area	← **5:1**
	inches	D_{FC} = filter course thickness	← **12"**
Sheet		Note what sheet in the plan set contains the filter course spec.	← **304.1 sand**

1. If the practice is a tree box filter, the drainage area shall be < 0.1 acre

2. Rate of the limiting layer (either the filter course or the underlying soil). See Vol. 2 of the NH Stormwater Manual, Ch. 2-4, for guidance on determining the infiltration rate.

3. If not within a GPA or WSIPA: SHWT/Bedrock must be at least 1 foot below the filter course material (or an underdrain must drain the SHWT to at least one foot below the filter course material). If within a GPA or WSIPA: SHWT must be at least two feet below the bottom of the practice OR the filter course material must be at least twice as thick as required and the SHWT must be at least one foot below the filter course material.

4. Volume without depending on infiltration. The storage above the filter media shall not include the volume above the outlet structure, if any.

5. The volume includes the storage above the filter but below the invert of the outlet structure (if any), the filter media voids, and the pretreatment area.

Designer's Notes:

*Above grade or surface sand filtration does not require an access grate.

Stage-Area-Storage for Pond INF1: Filltration Pond

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
632.25	2,455	0	634.85	4,657	9,445
632.30	2,502	124	634.90	4,691	9,678
632.35	2,548	250	634.95	4,724	9,914
632.40	2,595	379	635.00	4,758	10,151
632.45	2,642	510	635.05	4,791	10,389
632.50	2,689	643	635.10	4,824	10,630
632.55	2,735	779	635.15	4,858	10,872
632.60	2,782	916	635.20	4,891	11,115
632.65	2,829	1,057	635.25	4,924	11,361
632.70	2,875	1,199	635.30	4,958	11,608
632.75	2,922	1,344	635.35	4,991	11,857
632.80	2,969	1,492	635.40	5,024	12,107
632.85	3,016	1,641	635.45	5,058	12,359
632.90	3,062	1,793	635.50	5,091	12,613
632.95	3,109	1,947	635.55	5,125	12,868
633.00	3,156	2,104	635.60	5,158	13,125
633.05	3,202	2,263	635.65	5,191	13,384
633.10	3,249	2,424	635.70	5,225	13,644
633.15	3,296	2,588	635.75	5,258	13,906
633.20	3,343	2,754	635.80	5,291	14,170
633.25	3,389	2,922	635.85	5,325	14,436
633.30	3,436	3,093	635.90	5,358	14,703
633.35	3,483	3,266	635.95	5,392	14,971
633.40	3,529	3,441	636.00	5,425	15,242
633.45	3,576	3,619	636.05	5,541	15,516
633.50	3,623	3,799	636.10	5,657	15,796
633.55	3,670	3,981	636.15	5,773	16,082
633.60	3,716	4,166	636.20	5,889	16,373
633.65	3,763	4,353	636.25	6,005	16,671
633.70	3,810	4,542	636.30	6,121	16,974
633.75	3,856	4,734	636.35	6,237	17,283
633.80	3,903	4,928	636.40	6,353	17,597
633.85	3,950	5,124	636.45	6,469	17,918
633.90	3,997	5,323	636.50	**6,585**	**18,244**
633.95	4,043	5,524			
634.00	4,090	5,727			
634.05	4,123	5,932			
634.10	4,157	6,139			
634.15	4,190	6,348			
634.20	4,224	6,558			
634.25	4,257	6,770			
634.30	4,290	6,984			
634.35	4,324	7,199			
634.40	4,357	7,416			
634.45	4,390	7,635			
634.50	4,424	7,855			
634.55	4,457	8,077			
634.60	4,491	8,301			
634.65	4,524	8,526			
634.70	4,557	8,753			
634.75	4,591	8,982			
634.80	4,624	9,212			

Ground Water Recharge Rate
For Ground Water Recharge Volume GRV

By: DEB
Date: 10/15/2013
Project: Wild Meadows

Infiltration Pond INF1

GRV Storage Volume (HydroCad Model) = 2922 cf GRV

Average Area of Pond = 3675 sf Area

Infiltration Rate (from field data)= 2.5 in/hr Rate

GRV/Area= 0.80 ft X 12 in / ft = 9.54 in X 1 hr / rate in/hr = 3.82

Pond draw down 72 > = 3.82 hr

Draw Down Time is Less than 72 hr OK

TREATMENT SWALE DESIGN CRITERIA (Env-Wq 1508.07)

Node Name: **Wild Meadows Substation TS1**

Enter the node name in the drainage analysis (e.g., reach TS 5), if applicable

Yes	Yes/No	Have you reviewed the restrictions on unlined swales outlined in Env-Wq 1508.07(b)?	
no	Yes/No	Is the system lined?	
0.52	ac	A = Area draining to the practice	
0.12	ac	A_I = Impervious area draining to the practice	
8.9	minutes	T_c = Time of Concentration	
0.23	decimal	I = percent impervious area draining to the practice, in decimal form	
0.26	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.13	ac-in	WQV= 1" x Rv x A	
486	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1	inches	P = amount of rainfall. For WQF in NH, P = 1".	
0.26	inches	Q = water quality depth. Q = WQV/A	
88	unitless	CN = unit peak discharge curve number. CN =1000/(10+5P+10Q–10*[Q^2 + 1.25*Q*P]$^{0.5}$)	
1.34	inches	S = potential maximum retention. S = (1000/CN) - 10	
0.269	inches	Ia = initial abstraction. Ia = 0.2S	
550	cfs/mi^2/in	qu = unit peak discharge. Obtain this value from TR-55 exhibits 4-II and 4-III	
0.12	cfs	WQF = q_u x WQV. Conversion: to convert "cfs/mi^2/in * ac-in" to "cfs" multiply by 1mi^2/640ac	
120.00	feet	L = swale length [1]	← **≥ 100'**
5.00	feet	w = bottom of the swale width[2]	← **0 - 8 feet** [2]
606.50	feet	E_{SHWT} = elevation of SHWT. If none found, use the lowest elev. of test pit	
606.75	feet	E_{BTM} = elevation of the bottom of the practice	← **≥ E_{SHWT}**
3.0	:1	SS_{RIGHT} = right Side slope	← **≥3:1**
3.0	:1	SS_{LEFT} = left Side slope	← **≥3:1**
0.010	ft/ft	S = slope of swale in decimal form[3]	← **0.005 - .05**
1.3	inches	d = flow depth in swale at WQF (attach stage-discharge table)[4]	← **≤ 4"**
0.15	unitless	d must be < 4", therefore Manning's n = 0.15	
0.59	ft^2	Cross-sectional area check (assume trapezoidal channel)	
5.70	feet	Check wetted perimeter	
0.13	cfs	WQF_{check}.[5] ← **WQF_{check} = WQF**	
10%		Percent difference between WQF_{check} and WQF [5]	← **+/- 10%**
10	minutes	HRT = hydraulic residence time during the WQF	← **≥ 10 min**
608.17	ft	Peak elevation of the 10-year storm event	
609.25	ft	Elevation of the top of the swale	
YES	Yes/No	10 peak elevation ≤ the top of swale	← **yes**

1. Any portion of the swale that is in a roadside ditch shall not count towards the swale length.
2. Widths up to 16' allowed if a dividing berm or structure is used such that neither width is more than 8'.
3. If > 0.02 (2%) then check dams are required. No additional detention time is credited for check dams.
4. If a detention structure is used immediately upstream of the swale, the flow depth in the swale shall be no greater than 4" during the peak of the 2-yr storm, 24-hour storm event.
5. The WQF_{check} & WQF should be near equal (within 10%) to confirm that you have selected the correct depth off the stage-discharge table. If the depth is not accurate the HRT will be incorrect.

Designer's Notes:

WILD MEADOWS SUBSTATION – TS1 (QU – UNIT PEAK DISCHARGE)

Exhibit 4-II Unit peal discharge (q_u) for NRCS (SCS) type II rainfall distribution

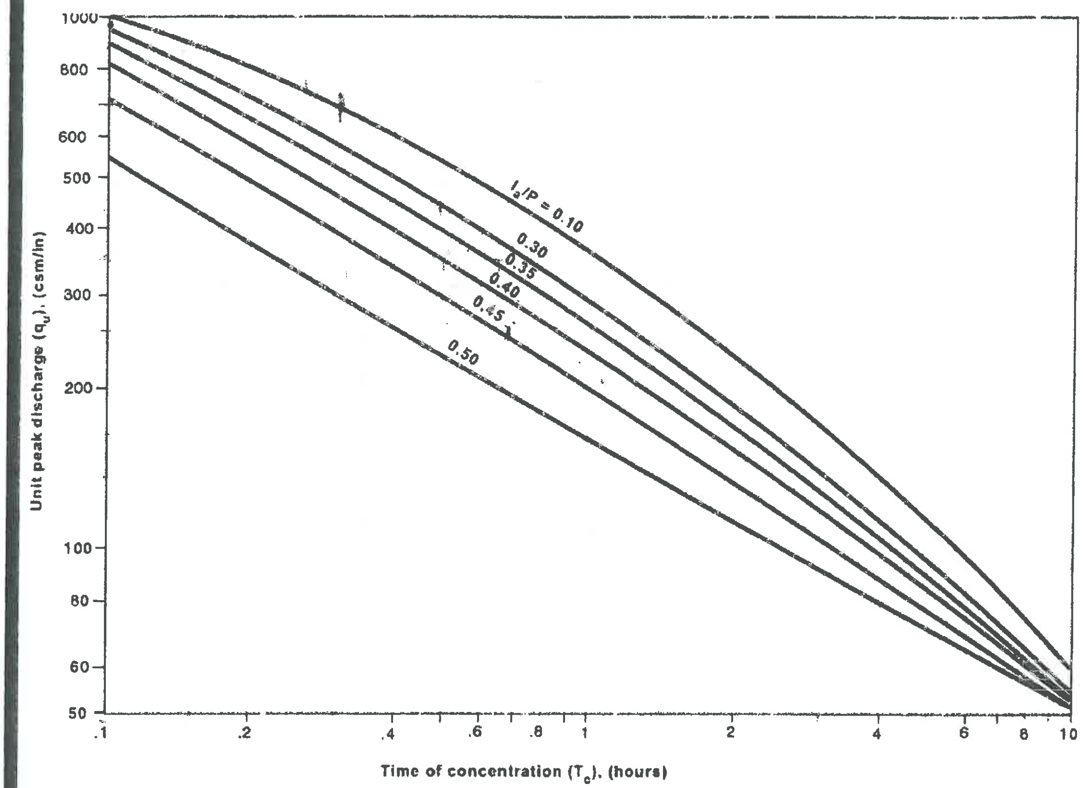


Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution

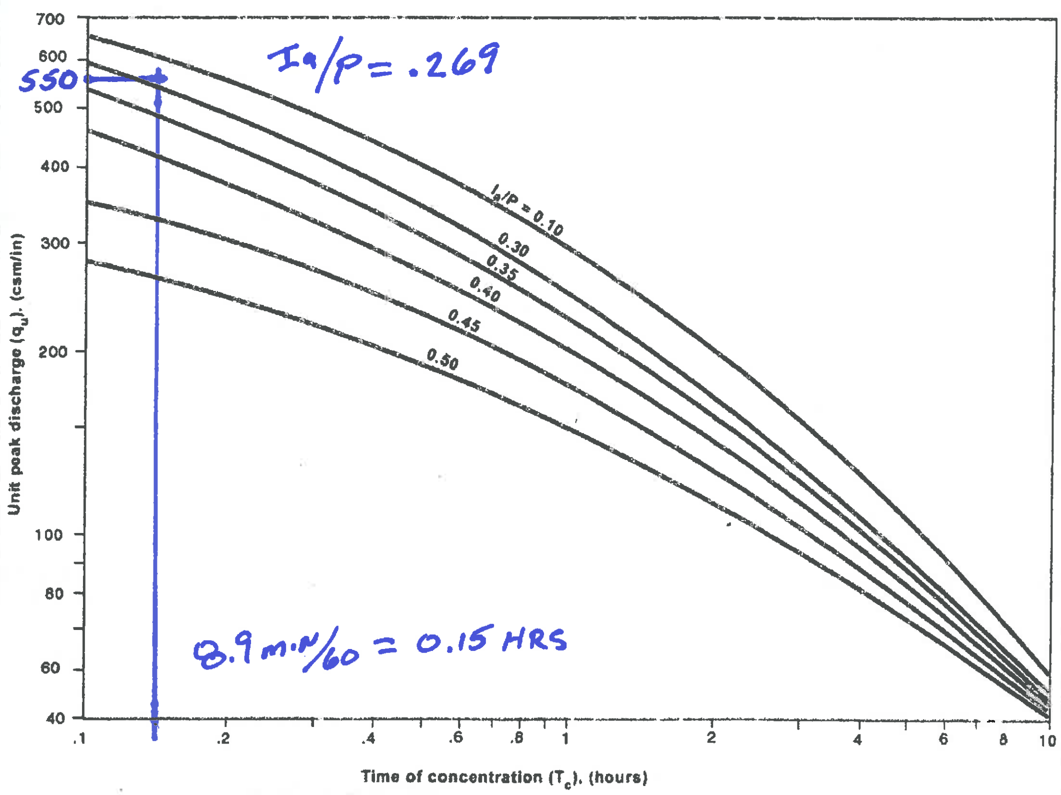


Figure 2-1. Exhibits 4-II and 4-III: Unit Peak Discharge for NRCS Rainfall Distributions

Stage-Discharge for Reach TS1: Treatment Swale 1

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
607.95	0.00	0.00
607.96	0.03	0.00
607.97	0.07	0.01
607.98	0.09	0.02
607.99	0.11	0.02
608.00	0.13	0.03
608.01	0.15	0.05
608.02	0.16	0.06
608.03	0.18	0.08
608.04	0.19	0.09
608.05	0.20	0.11
608.06	0.22	0.13
608.07	0.23	0.15
608.08	0.24	0.17
608.09	0.25	0.19
608.10	0.26	0.22
608.11	0.27	0.24
608.12	0.28	0.27
608.13	0.29	0.29
608.14	0.30	0.32
608.15	0.31	0.35
608.16	0.32	0.38
608.17	0.33	0.42
608.18	0.34	0.45
608.19	0.35	0.48
608.20	0.36	0.52
608.21	0.37	0.55
608.22	0.38	0.59
608.23	0.38	0.63
608.24	0.39	0.67
608.25	0.40	0.71
608.26	0.41	0.75
608.27	0.42	0.79
608.28	0.42	0.84
608.29	0.43	0.88
608.30	0.44	0.93
608.31	0.44	0.97
608.32	0.45	1.02
608.33	0.46	1.07
608.34	0.47	1.12
608.35	0.47	1.17
608.36	0.48	1.22
608.37	0.49	1.28
608.38	0.49	1.33
608.39	0.50	1.39
608.40	0.51	1.44
608.41	0.51	1.50
608.42	0.52	1.56
608.43	0.52	1.62
608.44	0.53	1.68
608.45	0.54	1.74
608.46	0.54	1.81
608.47	0.55	1.87
608.48	0.55	1.94
608.49	0.56	2.00
608.50	0.57	2.07
608.51	0.57	2.14
608.52	0.58	2.21
608.53	0.58	2.28
608.54	0.59	2.35
608.55	0.59	2.42
608.56	0.60	2.50
608.57	0.60	2.57
608.58	0.61	2.65
608.59	0.62	2.73
608.60	0.62	2.80
608.61	0.63	2.88
608.62	0.63	2.96
608.63	0.64	3.05
608.64	0.64	3.13
608.65	0.65	3.21
608.66	0.65	3.30
608.67	0.66	3.38
608.68	0.66	3.47
608.69	0.67	3.56
608.70	0.67	3.65
608.71	0.68	3.74
608.72	0.68	3.84
608.73	0.69	3.93
608.74	0.69	4.02
608.75	0.70	4.12
608.76	0.70	4.22
608.77	0.71	4.31
608.78	0.71	4.41
608.79	0.71	4.51
608.80	0.72	4.62
608.81	0.72	4.72
608.82	0.73	4.82
608.83	0.73	4.93
608.84	0.74	5.03
608.85	0.74	5.14
608.86	0.75	5.25
608.87	0.75	5.36
608.88	0.76	5.47
608.89	0.76	5.59
608.90	0.76	5.70
608.91	0.77	5.81
608.92	0.77	5.93
608.93	0.78	6.05
608.94	0.78	6.17
608.95	0.79	6.29
608.96	0.79	6.41
608.97	0.79	6.53
608.98	0.80	6.65
608.99	0.80	6.78
609.00	0.81	6.91
609.01	0.81	7.03
609.02	0.82	7.16
609.03	0.82	7.29
609.04	0.82	7.42
609.05	0.83	7.56
609.06	0.83	7.69
609.07	0.84	7.83
609.08	0.84	7.96
609.09	0.84	8.10
609.10	0.85	8.24
609.11	0.85	8.38
609.12	0.86	8.52
609.13	0.86	8.67
609.14	0.86	8.81
609.15	0.87	8.96
609.16	0.87	9.10
609.17	0.88	9.25
609.18	0.88	9.40
609.19	0.88	9.55
609.20	0.89	9.70
609.21	0.89	9.86
609.22	0.89	10.01
609.23	0.90	10.17
609.24	0.90	10.33
609.25	0.91	10.49
609.26	0.91	10.65
609.27	0.91	10.81
609.28	0.92	10.97
609.29	0.92	11.14
609.30	0.93	11.30
609.31	0.93	11.47
609.32	0.93	11.64
609.33	0.94	11.81
609.34	0.94	11.98
609.35	0.94	12.15
609.36	0.95	12.33
609.37	0.95	12.50
609.38	0.95	12.68
609.39	0.96	12.86
609.40	0.96	13.04
609.41	0.97	13.22
609.42	0.97	13.41
609.43	0.97	13.59
609.44	0.98	13.78
609.45	0.98	13.96
609.46	0.98	14.15
609.47	0.99	14.34
609.48	0.99	14.53
609.49	0.99	14.73
609.50	1.00	14.92

608.06 − 607.95 = 0.11' (12) = 1.32"

Stage-Discharge for Reach TS1: Treatment Swale 1 (continued)

Elevation (feet)	Velocity (ft/sec)	Discharge (cfs)
609.51	1.00	15.12
609.52	1.00	15.31
609.53	1.01	15.51
609.54	1.01	15.71
609.55	1.02	15.92
609.56	1.02	16.12
609.57	1.02	16.32
609.58	1.03	16.53
609.59	1.03	16.74
609.60	1.03	16.95
609.61	1.04	17.16
609.62	1.04	17.37
609.63	1.04	17.58
609.64	1.05	17.80
609.65	1.05	18.02
609.66	1.05	18.23
609.67	1.06	18.46
609.68	1.06	18.68
609.69	1.06	18.90
609.70	1.07	19.12
609.71	1.07	19.35
609.72	1.07	19.58
609.73	1.08	19.81
609.74	1.08	20.04
609.75	1.08	20.27
609.76	1.09	20.50
609.77	1.09	20.74
609.78	1.09	20.98
609.79	1.10	21.21
609.80	1.10	21.45
609.81	1.10	21.70
609.82	1.11	21.94
609.83	1.11	22.18
609.84	1.11	22.43
609.85	1.12	22.68
609.86	1.12	22.93
609.87	1.12	23.18
609.88	1.13	23.43
609.89	1.13	23.68
609.90	1.13	23.94
609.91	1.13	24.20
609.92	1.14	24.46
609.93	1.14	24.72
609.94	1.14	24.98
609.95	1.15	25.24
609.96	1.15	25.51
609.97	1.15	25.78
609.98	1.16	26.05
609.99	1.16	26.32
610.00	1.16	26.59
610.01	1.17	26.86
610.02	1.17	27.14
610.03	1.17	27.42
610.04	1.18	27.69
610.05	1.18	27.97
610.06	1.18	28.26
610.07	1.19	28.54
610.08	1.19	28.83
610.09	1.19	29.11
610.10	1.19	29.40
610.11	1.20	29.69
610.12	1.20	29.98
610.13	1.20	30.28
610.14	1.21	30.57
610.15	1.21	30.87
610.16	1.21	31.17
610.17	1.22	31.47
610.18	1.22	31.77
610.19	1.22	32.08
610.20	**1.22**	**32.38**

STORMWATER POND DESIGN CRITERIA (Env-Wq 1508.03)

Type/Node Name: **Micro Pool Pond MP1**

Enter the type of stormwater pond (e.g., Wet Pond) and the node name in the drainage analysis, if applicable

1.63	ac	A = Area draining to the practice	
1.25	ac	A_I = Impervious area draining to the practice	
0.77	decimal	I = percent impervious area draining to the practice, in decimal form	
0.74	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
1.21	ac-in	WQV= 1" x Rv x A	
4,380	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
438	cf	10% x WQV (check calc for sediment forebay and micropool volume)	
2,190	cf	50% x WQV (check calc for extended detention volume)	
1,833	cf	V_{SED} = sediment forebay volume	← **≥ 10%WQV**
630	cf	V_{PP} = permanent pool volume (volume below the lowest invert of the outlet structure)	
3,750	cf	V_{ED} = WQV - V_{PP} = extended detention volume	← **≤ X%[1] WQV**
623.40		E_{ED} = elevation of V_{ED} (attach stage-storage table)	
0.09	cfs	$2Q_{avg}$ = 2* V_{ED} / 24 hrs * (1hr / 3600 sec) (used to check against Q_{EDmax} below)	
0.08	cfs	Q_{EDmax} = discharge at the E_{ED} (attach stage-discharge table)	← **<$2Q_{avg}$**
26.04	hours	T_{ED} = drawdown time of extended detention = $2V_{ED}/Q_{EDmax}$	← **≥ 24-hrs**
3.00	:1	Pond side slopes	← **≥3:1**
3.01	ft	Average permanent pool depth	← **3 - 6 ft**
4.50	ft	Maximum depth of permanent pool	← **≤ 8 ft**
120.00	ft	Length of the flow path between the inlet and outlet at mid-depth	
23.00	ft	Average Width ([average of the top width + average bottom width]/2)	
5.22	:1	Length to Average Width ratio	← **≥ 3:1**
Yes	Yes/No	The perimeter should be curvilinear.	
Yes	Yes/No	The inlet and outlet should be located as far apart as possible.	
no	Yes/No	Is there a manually-controlled drain provided to dewater the pond over a 24hr period?	
If no state why:		orifice is set at the permanent pool elevation, which is less than 4 feet deep	
debris cage		What mechanism is proposed to prevent the outlet structure from clogging (applicable for orifices/weirs with a dimension of ≤6")?	
624.86	ft	Peak elevation of the 50-year storm event	
627.00	ft	Berm elevation of the pond	
YES		50 peak elevation ≤ the berm elevation?	← **yes**

Qualified professional that developed the planting plan:

Name, Profession:

1. "X" varies depending on type of stormwater pond design. See NH Stormwater Manual, Vol.2, Ch.4-3, Section 1, for the design permanent pool volumes and extended detention volumes.

Designer's Notes:

Submerged Orifice Flow

Qmax at the E_{ED}

Performed By:	DEB
Checked By:	AC
Date:	10/14/2013

$Q_o = C_o * A_o \sqrt{2g\,(H-E_o)}$ provided that (H-Eo > 0.5 D

Source: "Stormwater Collection Systems Design Handbook", Larry W. Mays, PH.D., P.H.

where	Qo = orifice outflow		
	Co = orifice discharge coefficient	0.614	(Circular)
	g = gravitational acceleration	32	ft/s2
	Ao = net opening area		
	H = water surface stage	**RED**	user input \
	Eo = center elevation of orifice	**BLACK**	calculated \

diameter of orifice =	**1.3**	inches	**0.11**	feet
orifice elevation =	**620.50**	feet		
water quality volume elevation (hydrocad output) **(H)** =	**623.40**	feet		
Eo =	**620.55**	**feet**		

is (H-Eo > 0.5 D?	**2.85**	ft	>	**0.05**	**yes**

Ao =	**0.009**	**sf**
Qo =	**0.077**	**cfs**

Average Pond Depth-Micro Extended Detention Pond

Performed By: DEB
Checked By: AJC
Date: 10/15/2013

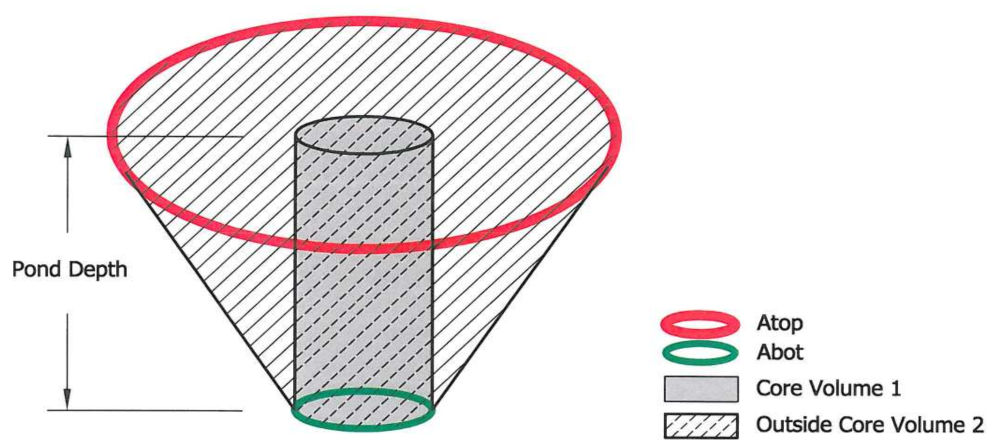
Atot = Abot + Atop

$$\text{Davg} = \frac{\overbrace{(\text{Atop} - \text{Abot}) \times (\text{Pond depth} / 2)}^{\text{<Outside Core Volume 2>}} + \overbrace{(\text{Abot} \times \text{Pond Depth})}^{\text{<Core Volume 1>}}}{\text{Atop}}$$

Pond Depth =	4.5	Feet
Atop (Top of Pond Area) =	210	SF
Abot (Bottom of Pond Area) =	71	SF

RED user input values
BLACK calculated values

Davg = **3.01 Feet**



Stage-Area-Storage for Pond MP1: Miro Pool 1 (continued)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
620.68	677	622.24	1,886	623.80	4,652
620.71	687	622.27	1,924	623.83	4,722
620.74	697	622.30	1,962	623.86	4,791
620.77	708	622.33	2,001	623.89	4,862
620.80	719	622.36	2,041	623.92	4,933
620.83	731	622.39	2,081	623.95	5,004
620.86	744	622.42	2,122	623.98	5,077
620.89	757	622.45	2,163	624.01	5,149
620.92	770	622.48	2,205	624.04	5,223
620.95	784	622.51	2,248	624.07	5,297
620.98	798	622.54	2,291	624.10	5,372
621.01	813	622.57	2,335	624.13	5,447
621.04	829	622.60	2,380	624.16	5,524
621.07	845	622.63	2,425	624.19	5,601
621.10	862	622.66	2,470	624.22	5,678
621.13	879	622.69	2,517	624.25	5,756
621.16	896	622.72	2,563	624.28	5,835
621.19	915	622.75	2,611	624.31	5,915
621.22	933	622.78	2,659	624.34	5,995
621.25	953	622.81	2,708	624.37	6,076
621.28	972	622.84	2,757	624.40	6,158
621.31	993	622.87	2,807	624.43	6,241
621.34	1,013	622.90	2,857	624.46	6,324
621.37	1,035	622.93	2,908	624.49	6,408
621.40	1,057	622.96	2,960	624.52	6,492
621.43	1,079	622.99	3,012	624.55	6,577
621.46	1,102	623.02	3,065	624.58	6,663
621.49	1,125	623.05	3,119	624.61	6,750
621.52	1,149	623.08	3,173	624.64	6,837
621.55	1,174	623.11	3,228	624.67	6,925
621.58	1,199	623.14	3,283	624.70	7,013
621.61	1,225	623.17	3,339	624.73	7,103
621.64	1,251	623.20	3,395	624.76	7,193
621.67	1,277	623.23	3,453	624.79	7,283
621.70	1,304	623.26	3,510	624.82	7,375
621.73	1,332	623.29	3,569	624.85	7,467
621.76	1,360	623.32	3,628	624.88	7,560
621.79	1,389	623.35	3,687	624.91	7,653
621.82	1,418	623.38	3,747	624.94	7,747
621.85	1,448	623.41	3,808	624.97	7,842
621.88	1,478	623.44	3,869	625.00	7,938
621.91	1,509	623.47	3,931	625.03	8,034
621.94	1,541	623.50	3,994	625.06	8,131
621.97	1,573	623.53	4,057	625.09	8,228
622.00	1,605	623.56	4,121	625.12	8,326
622.03	1,638	623.59	4,185	625.15	8,425
622.06	1,672	623.62	4,250	625.18	8,525
622.09	1,706	623.65	4,316	625.21	8,625
622.12	1,741	623.68	4,382	625.24	8,726
622.15	1,776	623.71	4,448	625.27	8,828
622.18	1,812	623.74	4,516	625.30	8,930
622.21	1,849	623.77	4,584	625.33	9,034

Stage-Discharge for Pond MP1: Miro Pool 1 (continued)

Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)	Elevation (feet)	Discharge (cfs)	Primary (cfs)	Secondary (cfs)
622.24	0.06	0.06	0.00	623.80	0.71	0.71	0.00
622.27	0.06	0.06	0.00	623.83	0.80	0.80	0.00
622.30	0.06	0.06	0.00	623.86	0.90	0.90	0.00
622.33	0.06	0.06	0.00	623.89	0.99	0.99	0.00
622.36	0.06	0.06	0.00	623.92	1.09	1.09	0.00
622.39	0.06	0.06	0.00	623.95	1.20	1.20	0.00
622.42	0.06	0.06	0.00	623.98	1.31	1.31	0.00
622.45	0.06	0.06	0.00	624.01	1.42	1.42	0.00
622.48	0.06	0.06	0.00	624.04	1.53	1.53	0.00
622.51	0.06	0.06	0.00	624.07	1.64	1.64	0.00
622.54	0.06	0.06	0.00	624.10	1.76	1.76	0.00
622.57	0.06	0.06	0.00	624.13	1.87	1.87	0.00
622.60	0.06	0.06	0.00	624.16	1.99	1.99	0.00
622.63	0.06	0.06	0.00	624.19	2.10	2.10	0.00
622.66	0.06	0.06	0.00	624.22	2.21	2.21	0.00
622.69	0.06	0.06	0.00	624.25	2.32	2.32	0.00
622.72	0.07	0.07	0.00	624.28	2.42	2.42	0.00
622.75	0.07	0.07	0.00	624.31	2.52	2.52	0.00
622.78	0.07	0.07	0.00	624.34	2.62	2.62	0.00
622.81	0.07	0.07	0.00	624.37	2.70	2.70	0.00
622.84	0.07	0.07	0.00	624.40	2.76	2.76	0.00
622.87	0.07	0.07	0.00	624.43	2.84	2.84	0.00
622.90	0.07	0.07	0.00	624.46	2.92	2.92	0.00
622.93	0.07	0.07	0.00	624.49	2.99	2.99	0.00
622.96	0.07	0.07	0.00	624.52	3.07	3.07	0.00
622.99	0.07	0.07	0.00	624.55	3.14	3.14	0.00
623.02	0.07	0.07	0.00	624.58	3.21	3.21	0.00
623.05	0.07	0.07	0.00	624.61	3.28	3.28	0.00
623.08	0.07	0.07	0.00	624.64	3.34	3.34	0.00
623.11	0.07	0.07	0.00	624.67	3.41	3.41	0.00
623.14	0.07	0.07	0.00	624.70	3.47	3.47	0.00
623.17	0.07	0.07	0.00	624.73	3.54	3.54	0.00
623.20	0.07	0.07	0.00	624.76	3.60	3.60	0.00
623.23	0.07	0.07	0.00	624.79	3.66	3.66	0.00
623.26	0.07	0.07	0.00	624.82	3.72	3.72	0.00
623.29	0.07	0.07	0.00	624.85	3.78	3.78	0.00
623.32	0.07	0.07	0.00	624.88	3.84	3.84	0.00
623.35	0.07	0.07	0.00	624.91	3.89	3.89	0.00
623.38	0.07	0.07	0.00	624.94	3.95	3.95	0.00
623.41	0.08	0.08	0.00	624.97	4.01	4.01	0.00
623.44	0.08	0.08	0.00	625.00	4.06	4.06	0.00
623.47	0.10	0.10	0.00	625.03	4.11	4.11	0.00
623.50	0.12	0.12	0.00	625.06	4.17	4.17	0.00
623.53	0.15	0.15	0.00	625.09	4.22	4.22	0.00
623.56	0.19	0.19	0.00	625.12	4.27	4.27	0.00
623.59	0.23	0.23	0.00	625.15	4.32	4.32	0.00
623.62	0.28	0.28	0.00	625.18	4.37	4.37	0.00
623.65	0.34	0.34	0.00	625.21	4.42	4.42	0.00
623.68	0.40	0.40	0.00	625.24	4.47	4.47	0.00
623.71	0.47	0.47	0.00	625.27	4.52	4.52	0.00
623.74	0.55	0.55	0.00	625.30	4.57	4.57	0.00
623.77	0.63	0.63	0.00	625.33	4.62	4.62	0.00

C. Operation and Maintenance Building

FILTRATION PRACTICE DESIGN CRITERIA (Env-Wq 1508.06)

Type/Node Name: **Operations and Maintenance Facility Filtration Pond**

Enter the type of filtration practice (e.g., bioretention system) and the node name in the drainage analysis, if applicable

yes		Have you reviewed the restrictions on unlined systems outlined in Env-Wq 1508.06(b)?	
4.65	ac	A = Area draining to the practice[1]	
2.14	ac	A_I = Impervious area draining to the practice	
0.46	decimal	I = percent impervious area draining to the practice, in decimal form	
0.46	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
2.16	ac-in	WQV= 1” x Rv x A	
7,835	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12”)	
1,959	cf	25% x WQV (check calc for sediment forebay volume)	
5,877	cf	75% x WQV (check calc for surface sand filter volume)	
Forebay		Method of Pretreatment? (not required for clean or roof runoff)	
1,961	cf	V_{SED} = sediment forebay volume, if used for pretreatment	**← ≥ 25%WQV**
2,450	sf	A_{SA} = surface area of the practice	
2.50	iph	I_{DESIGN} = design infiltration rate[2]	
n/a	Yes/No	If I_{DESIGN} is < 0.50 iph, has an underdrain been provided?	
15.4	hours	T_{DRAIN} = drain time = V / (A_{SA} * I_{DESIGN})	**← ≤ 72-hrs**
1,351.41	feet	E_{FC} = elevation of the bottom of the filter course material	
n/a	feet	E_{UD} = invert elevation of the underdrain (UD), if applicable	
1,351.08	feet	E_{BTM} = elevation of the bottom of the practice (i.e., bottom of the stone reservoir).	
1,350.00	feet	E_{SHWT} = elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
1,348.00	feet	E_{ROCK} = elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
#VALUE!	feet	$D_{FC\ to\ UD}$ = depth to UD from the bottom of the filter course[3]	**← ≥ 1'**
3.41	feet	$D_{FC\ to\ ROCK}$ = depth to bedrock from the bottom of the filter course[3]	**← ≥ 1'**
1.41	feet	$D_{FC\ to\ SHWT}$ = depth to SHWT from the bottom of the filter course[3]	**← ≥ 1'**
1.08	feet	$D_{BTM\ to\ SHWT}$ = depth to SHWT from the bottom of the practice[3]	**← ≥ 2'**
1,356.64	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
1,358.00	ft	Elevation of the top of the practice	
YES		10 peak elevation ≤ Elevation of the top of the practice	**← yes**

If a surface sand filter is proposed:

YES	ac	Drainage Area check.	**← < 10 ac**
8,542	cf	V = volume of storage[4, 5] (attach a stage-storage table)	**← ≥ 75%WQV**
18.0	inches	D_{FC} = filter course thickness	**← 18"**
Sheet	D1.4	Note what sheet in the plan set contains the filter course specification	
no	Yes/No	Access grate provided?	**← yes**
1" of Gravel		The filter shall not be covered in grass. What is covering the filter?	

If an underground sand filter is proposed:

YES	ac	Drainage Area check.	**← < 10 ac**
	cf	V = volume of storage[4, 5] (attach a stage-storage table)	**← ≥ 75%WQV**
	inches	D_{FC} = filter course thickness	**← 24"**
Sheet		Note what sheet in the plan set contains the filter course specification	
	Yes/No	Access grate provided?	**← yes**

If a bioretention area is proposed:

YES	ac	Drainage Area no larger than 5 ac?	← **yes**
	cf	V = volume of storage[4, 5] (attach a stage-storage table)	← **≥ WQV**
	inches	D_{FC} = filter course thickness	← **18"**
Sheet		Note what sheet in the plan set contains the filter course specification	
	:1	Pond side slopes	← **≥2:1**
Sheet		Note what sheet in the plan set contains the planting plans and surface cover	

If porous pavement is proposed:

		Type of pavement proposed (concrete? Asphalt? Pavers? Etc)	
	acres	A_{SA} = surface area of the pervious pavement	
-	:1	ratio of the contributing area to the pervious surface area	← **5:1**
	inches	D_{FC} = filter course thickness	← **12"**
Sheet		Note what sheet in the plan set contains the filter course spec.	← **304.1 sand**

1. If the practice is a tree box filter, the drainage area shall be < 0.1 acre

2. Rate of the limiting layer (either the filter course or the underlying soil). See Vol. 2 of the NH Stormwater Manual, Ch. 2-4, for guidance on determining the infiltration rate.

3. If not within a GPA or WSIPA: SHWT/Bedrock must be at least 1 foot below the filter course material (or an underdrain must drain the SHWT to at least one foot below the filter course material). If within a GPA or WSIPA: SHWT must be at least two feet below the bottom of the practice OR the filter course material must be at least twice as thick as required and the SHWT must be at least one foot below the filter course material.

4. Volume without depending on infiltration. The storage above the filter media shall not include the volume above the outlet structure, if any.

5. The volume includes the storage above the filter but below the invert of the outlet structure (if any), the filter media voids, and the pretreatment area.

Designer's Notes: ______________________________

Stage-Area-Storage for Pond 2P: Infiltration Pond

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,353.00	2,450	0	1,353.52	2,762	1,355
1,353.01	2,456	25	1,353.53	2,768	1,383
1,353.02	2,462	49	1,353.54	2,774	1,410
1,353.03	2,468	74	1,353.55	2,780	1,438
1,353.04	2,474	98	1,353.56	2,786	1,466
1,353.05	2,480	123	1,353.57	2,792	1,494
1,353.06	2,486	148	1,353.58	2,798	1,522
1,353.07	2,492	173	1,353.59	2,804	1,550
1,353.08	2,498	198	1,353.60	2,810	1,578
1,353.09	2,504	223	1,353.61	2,816	1,606
1,353.10	2,510	248	1,353.62	2,822	1,634
1,353.11	2,516	273	1,353.63	2,828	1,663
1,353.12	2,522	298	1,353.64	2,834	1,691
1,353.13	2,528	324	1,353.65	2,840	1,719
1,353.14	2,534	349	1,353.66	2,846	1,748
1,353.15	2,540	374	1,353.67	2,852	1,776
1,353.16	2,546	400	1,353.68	2,858	1,805
1,353.17	2,552	425	1,353.69	2,864	1,833
1,353.18	2,558	451	1,353.70	2,870	1,862
1,353.19	2,564	476	1,353.71	2,876	1,891
1,353.20	2,570	502	1,353.72	2,882	1,920
1,353.21	2,576	528	1,353.73	2,888	1,948
1,353.22	2,582	554	1,353.74	2,894	1,977
1,353.23	2,588	579	1,353.75	2,900	2,006
1,353.24	2,594	605	1,353.76	2,906	2,035
1,353.25	2,600	631	1,353.77	2,912	2,064
1,353.26	2,606	657	1,353.78	2,918	2,094
1,353.27	2,612	683	1,353.79	2,924	2,123
1,353.28	2,618	710	1,353.80	2,930	2,152
1,353.29	2,624	736	1,353.81	2,936	2,181
1,353.30	2,630	762	1,353.82	2,942	2,211
1,353.31	2,636	788	1,353.83	2,948	2,240
1,353.32	2,642	815	1,353.84	2,954	2,270
1,353.33	2,648	841	1,353.85	2,960	2,299
1,353.34	2,654	868	1,353.86	2,966	2,329
1,353.35	2,660	894	1,353.87	2,972	2,359
1,353.36	2,666	921	1,353.88	2,978	2,388
1,353.37	2,672	948	1,353.89	2,984	2,418
1,353.38	2,678	974	1,353.90	2,990	2,448
1,353.39	2,684	1,001	1,353.91	2,996	2,478
1,353.40	2,690	1,028	1,353.92	3,002	2,508
1,353.41	2,696	1,055	1,353.93	3,008	2,538
1,353.42	2,702	1,082	1,353.94	3,014	2,568
1,353.43	2,708	1,109	1,353.95	3,020	2,598
1,353.44	2,714	1,136	1,353.96	3,026	2,628
1,353.45	2,720	1,163	1,353.97	3,032	2,659
1,353.46	2,726	1,190	1,353.98	3,038	2,689
1,353.47	2,732	1,218	1,353.99	3,044	2,720
1,353.48	2,738	1,245	1,354.00	3,155	2,750
1,353.49	2,744	1,273	1,354.01	3,164	2,782
1,353.50	2,750	1,300	1,354.02	3,172	2,813
1,353.51	2,756	1,328	1,354.03	3,181	2,845

Stage-Area-Storage for Pond 2P: Infiltration Pond (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,354.04	3,189	2,877	1,354.56	3,638	4,652
1,354.05	3,198	2,909	1,354.57	3,647	4,688
1,354.06	3,207	2,941	1,354.58	3,655	4,725
1,354.07	3,215	2,973	1,354.59	3,664	4,762
1,354.08	3,224	3,005	1,354.60	3,672	4,798
1,354.09	3,233	3,037	1,354.61	3,681	4,835
1,354.10	3,241	3,070	1,354.62	3,690	4,872
1,354.11	3,250	3,102	1,354.63	3,698	4,909
1,354.12	3,258	3,135	1,354.64	3,707	4,946
1,354.13	3,267	3,167	1,354.65	3,716	4,983
1,354.14	3,276	3,200	1,354.66	3,724	5,020
1,354.15	3,284	3,233	1,354.67	3,733	5,057
1,354.16	3,293	3,266	1,354.68	3,742	5,095
1,354.17	3,302	3,299	1,354.69	3,750	5,132
1,354.18	3,310	3,332	1,354.70	3,759	5,170
1,354.19	3,319	3,365	1,354.71	3,767	5,207
1,354.20	3,328	3,398	1,354.72	3,776	5,245
1,354.21	3,336	3,432	1,354.73	3,785	5,283
1,354.22	3,345	3,465	1,354.74	3,793	5,321
1,354.23	3,353	3,498	1,354.75	3,802	5,359
1,354.24	3,362	3,532	1,354.76	3,810	5,397
1,354.25	3,371	3,566	1,354.77	3,819	5,435
1,354.26	3,379	3,599	1,354.78	3,828	5,473
1,354.27	3,388	3,633	1,354.79	3,836	5,512
1,354.28	3,396	3,667	1,354.80	3,845	5,550
1,354.29	3,405	3,701	1,354.81	3,854	5,588
1,354.30	3,414	3,735	1,354.82	3,862	5,627
1,354.31	3,422	3,769	1,354.83	3,871	5,666
1,354.32	3,431	3,804	1,354.84	3,879	5,704
1,354.33	3,440	3,838	1,354.85	3,888	5,743
1,354.34	3,448	3,873	1,354.86	3,897	5,782
1,354.35	3,457	3,907	1,354.87	3,905	5,821
1,354.36	3,465	3,942	1,354.88	3,914	5,860
1,354.37	3,474	3,976	1,354.89	3,923	5,900
1,354.38	3,483	4,011	1,354.90	3,931	5,939
1,354.39	3,491	4,046	1,354.91	3,940	5,978
1,354.40	3,500	4,081	1,354.92	3,949	6,018
1,354.41	3,509	4,116	1,354.93	3,957	6,057
1,354.42	3,517	4,151	1,354.94	3,966	6,097
1,354.43	3,526	4,186	1,354.95	3,974	6,136
1,354.44	3,535	4,222	1,354.96	3,983	6,176
1,354.45	3,543	4,257	1,354.97	3,992	6,216
1,354.46	3,552	4,293	1,354.98	4,000	6,256
1,354.47	3,560	4,328	1,354.99	4,009	6,296
1,354.48	3,569	4,364	1,355.00	4,018	6,336
1,354.49	3,578	4,399	1,355.01	4,026	6,376
1,354.50	3,586	4,435	1,355.02	4,035	6,417
1,354.51	3,595	4,471	1,355.03	4,043	6,457
1,354.52	3,603	4,507	1,355.04	4,052	6,498
1,354.53	3,612	4,543	1,355.05	4,061	6,538
1,354.54	3,621	4,579	1,355.06	4,069	6,579
1,354.55	3,629	4,616	1,355.07	4,078	6,620

Stage-Area-Storage for Pond 2P: Infiltration Pond (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,355.08	4,086	6,660	1,355.60	4,535	8,902
1,355.09	4,095	6,701	1,355.61	4,544	8,947
1,355.10	4,104	6,742	1,355.62	4,552	8,993
1,355.11	4,112	6,783	1,355.63	4,561	9,038
1,355.12	4,121	6,825	1,355.64	4,570	9,084
1,355.13	4,130	6,866	1,355.65	4,578	9,130
1,355.14	4,138	6,907	1,355.66	4,587	9,176
1,355.15	4,147	6,949	1,355.67	4,595	9,222
1,355.16	4,156	6,990	1,355.68	4,604	9,268
1,355.17	4,164	7,032	1,355.69	4,613	9,314
1,355.18	4,173	7,073	1,355.70	4,621	9,360
1,355.19	4,181	7,115	1,355.71	4,630	9,406
1,355.20	4,190	7,157	1,355.72	4,639	9,452
1,355.21	4,199	7,199	1,355.73	4,647	9,499
1,355.22	4,207	7,241	1,355.74	4,656	9,545
1,355.23	4,216	7,283	1,355.75	4,664	9,592
1,355.24	4,225	7,325	1,355.76	4,673	9,639
1,355.25	4,233	7,368	1,355.77	4,682	9,685
1,355.26	4,242	7,410	1,355.78	4,690	9,732
1,355.27	4,250	7,452	1,355.79	4,699	9,779
1,355.28	4,259	7,495	1,355.80	4,707	9,826
1,355.29	4,268	7,538	1,355.81	4,716	9,873
1,355.30	4,276	7,580	1,355.82	4,725	9,921
1,355.31	4,285	7,623	1,355.83	4,733	9,968
* 1,355.32	4,293	7,666	1,355.84	4,742	10,015
1,355.33	4,302	7,709	1,355.85	4,751	10,063
1,355.34	4,311	7,752	1,355.86	4,759	10,110
1,355.35	4,319	7,795	1,355.87	4,768	10,158
1,355.36	4,328	7,838	1,355.88	4,777	10,206
1,355.37	4,337	7,882	1,355.89	4,785	10,253
1,355.38	4,345	7,925	1,355.90	4,794	10,301
1,355.39	4,354	7,969	1,355.91	4,802	10,349
1,355.40	4,363	8,012	1,355.92	4,811	10,397
1,355.41	4,371	8,056	1,355.93	4,820	10,446
1,355.42	4,380	8,100	1,355.94	4,828	10,494
1,355.43	4,388	8,144	1,355.95	4,837	10,542
1,355.44	4,397	8,187	1,355.96	4,846	10,590
1,355.45	4,406	8,231	1,355.97	4,854	10,639
1,355.46	4,414	8,276	1,355.98	4,863	10,688
1,355.47	4,423	8,320	1,355.99	4,871	10,736
1,355.48	4,432	8,364	1,356.00	4,880	10,785
1,355.49	4,440	8,408	1,356.01	4,895	10,834
1,355.50	4,449	8,453	1,356.02	4,910	10,883
1,355.51	4,457	8,497	1,356.03	4,924	10,932
1,355.52	4,466	8,542	1,356.04	4,939	10,981
1,355.53	4,475	8,587	1,356.05	4,954	11,031
1,355.54	4,483	8,631	1,356.06	4,969	11,080
1,355.55	4,492	8,676	1,356.07	4,984	11,130
1,355.56	4,500	8,721	1,356.08	4,999	11,180
1,355.57	4,509	8,766	1,356.09	5,013	11,230
1,355.58	4,518	8,811	1,356.10	5,028	11,280
1,355.59	4,526	8,857	1,356.11	5,043	11,331

Stage-Area-Storage for Pond 2P: Infiltration Pond (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,356.12	5,058	11,381	1,356.64	5,829	14,212
1,356.13	5,073	11,432	1,356.65	5,844	14,270
1,356.14	5,088	11,483	1,356.66	5,859	14,329
1,356.15	5,103	11,534	1,356.67	5,874	14,388
1,356.16	5,117	11,585	1,356.68	5,889	14,446
1,356.17	5,132	11,636	1,356.69	5,904	14,505
1,356.18	5,147	11,687	1,356.70	5,918	14,564
1,356.19	5,162	11,739	1,356.71	5,933	14,624
1,356.20	5,177	11,791	1,356.72	5,948	14,683
1,356.21	5,192	11,843	1,356.73	5,963	14,743
1,356.22	5,206	11,894	1,356.74	5,978	14,802
1,356.23	5,221	11,947	1,356.75	5,993	14,862
1,356.24	5,236	11,999	1,356.76	6,007	14,922
1,356.25	5,251	12,051	1,356.77	6,022	14,982
1,356.26	5,266	12,104	1,356.78	6,037	15,043
1,356.27	5,280	12,157	1,356.79	6,052	15,103
1,356.28	5,295	12,210	1,356.80	6,067	15,164
1,356.29	5,310	12,263	1,356.81	6,081	15,224
1,356.30	5,325	12,316	1,356.82	6,096	15,285
1,356.31	5,340	12,369	1,356.83	6,111	15,346
1,356.32	5,355	12,423	1,356.84	6,126	15,408
1,356.33	5,369	12,476	1,356.85	6,141	15,469
1,356.34	5,384	12,530	1,356.86	6,156	15,530
1,356.35	5,399	12,584	1,356.87	6,170	15,592
1,356.36	5,414	12,638	1,356.88	6,185	15,654
1,356.37	5,429	12,692	1,356.89	6,200	15,716
1,356.38	5,444	12,746	1,356.90	6,215	15,778
1,356.39	5,459	12,801	1,356.91	6,230	15,840
1,356.40	5,473	12,856	1,356.92	6,245	15,902
1,356.41	5,488	12,910	1,356.93	6,260	15,965
1,356.42	5,503	12,965	1,356.94	6,274	16,028
1,356.43	5,518	13,021	1,356.95	6,289	16,090
1,356.44	5,533	13,076	1,356.96	6,304	16,153
1,356.45	5,548	13,131	1,356.97	6,319	16,216
1,356.46	5,562	13,187	1,356.98	6,334	16,280
1,356.47	5,577	13,242	1,356.99	6,349	16,343
1,356.48	5,592	13,298	1,357.00	6,363	16,407
1,356.49	5,607	13,354	1,357.01	6,378	16,470
1,356.50	5,622	13,410	1,357.02	6,393	16,534
1,356.51	5,636	13,467	1,357.03	6,408	16,598
1,356.52	5,651	13,523	1,357.04	6,423	16,662
1,356.53	5,666	13,580	1,357.05	6,437	16,727
1,356.54	5,681	13,636	1,357.06	6,452	16,791
1,356.55	5,696	13,693	1,357.07	6,467	16,856
1,356.56	5,711	13,750	1,357.08	6,482	16,920
1,356.57	5,725	13,808	1,357.09	6,497	16,985
1,356.58	5,740	13,865	1,357.10	6,512	17,050
1,356.59	5,755	13,922	1,357.11	6,526	17,116
1,356.60	5,770	13,980	1,357.12	6,541	17,181
1,356.61	5,785	14,038	1,357.13	6,556	17,246
1,356.62	5,800	14,096	1,357.14	6,571	17,312
1,356.63	5,815	14,154	1,357.15	6,586	17,378

Stage-Area-Storage for Pond 2P: Infiltration Pond (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
1,357.16	6,601	17,444
1,357.17	6,616	17,510
1,357.18	6,630	17,576
1,357.19	6,645	17,642
1,357.20	6,660	17,709
1,357.21	6,675	17,776
1,357.22	6,690	17,842
1,357.23	6,705	17,909
1,357.24	6,719	17,977
1,357.25	6,734	18,044
1,357.26	6,749	18,111
1,357.27	6,764	18,179
1,357.28	6,779	18,247
1,357.29	6,793	18,314
1,357.30	6,808	18,382
1,357.31	6,823	18,451
1,357.32	6,838	18,519
1,357.33	6,853	18,587
1,357.34	6,868	18,656
1,357.35	6,882	18,725
1,357.36	6,897	18,794
1,357.37	6,912	18,863
1,357.38	6,927	18,932
1,357.39	6,942	19,001
1,357.40	6,957	19,071
1,357.41	6,972	19,140
1,357.42	6,986	19,210
1,357.43	7,001	19,280
1,357.44	7,016	19,350
1,357.45	7,031	19,420
1,357.46	7,046	19,491
1,357.47	7,061	19,561
1,357.48	7,075	19,632
1,357.49	7,090	19,703
1,357.50	7,105	19,774
1,357.51	7,114	19,831
1,357.52	7,122	19,888
1,357.53	7,131	19,946
1,357.54	7,139	20,003
1,357.55	7,148	20,061
1,357.56	7,157	20,118
1,357.57	7,165	20,176
1,357.58	7,174	20,234
1,357.59	7,182	20,292
1,357.60	7,191	20,350
1,357.61	7,200	20,408
1,357.62	7,208	20,466
1,357.63	7,217	20,525
1,357.64	7,225	20,583
1,357.65	7,234	20,641
1,357.66	7,243	20,700
1,357.67	7,251	20,759
1,357.68	7,260	20,817
1,357.69	7,268	20,876
1,357.70	7,277	20,935
1,357.71	7,286	20,994
1,357.72	7,294	21,053
1,357.73	7,303	21,112
1,357.74	7,311	21,171
1,357.75	7,320	21,231
1,357.76	7,329	21,290
1,357.77	7,337	21,349
1,357.78	7,346	21,409
1,357.79	7,354	21,469
1,357.80	7,363	21,528
1,357.81	7,372	21,588
1,357.82	7,380	21,648
1,357.83	7,389	21,708
1,357.84	7,397	21,768
1,357.85	7,406	21,828
1,357.86	7,415	21,889
1,357.87	7,423	21,949
1,357.88	7,432	22,009
1,357.89	7,440	22,070
1,357.90	7,449	22,131
1,357.91	7,458	22,191
1,357.92	7,466	22,252
1,357.93	7,475	22,313
1,357.94	7,483	22,374
1,357.95	7,492	22,435
1,357.96	7,501	22,496
1,357.97	7,509	22,557
1,357.98	7,518	22,618
1,357.99	7,526	22,680
1,358.00	**7,535**	**22,741**

3.3 Pre-Development Analysis

3.3A Pre-Development Analysis

3.3A Pre-Development Analysis

Pre-Development Drainage Summary – 70% Civil Design, F14 Layout

Pre-development Drainage Analysis

Peak discharge rates were modeled using NRCS TR-20 / TR-55 procedures, run under HydroCAD Version 9.10, with the following inputs; Type III-24 hour rainfall events, pre-development cover and soil types, and drainage paths. Refer to tables within the **HydroCAD model output** for the drainage diagram, area and soil listing, node listing, and a full summary of the 10-year storm. Refer to the **Pre-Development Drainage Area Plan** and **Pre-Development Soil Plan**.

Pre-development Land Cover

The project site is dominated by two main forested ridgelines on which the wind turbines will be situated. The ridges are characterized by steep slopes with glacial till and boulders with some bedrock outcrops. Land cover is predominantly an industrial forest with ongoing timber harvesting operations unrelated to the wind power project. Various hardwood species make up the majority of the hill slope forest with patches of spruce on some hill tops. Due to the difficulty and effort involved in differentiating between areas of recently harvested, mid-age, and mature forest, a single composite curve number (CN) has been assigned to "woods" land cover for each hydrologic soil group (HSG). Field observation and aerial photography reveals that the majority of the forested area is a reasonably well distributed mix of vegetation ranging from mature trees to new regrowth in recently harvested areas, thus the assumption of a composite curve number is reasonable.

Other land cover types included in the drainage analysis include meadow (i.e. hay field or open area), residential lots (assumed 1 acre lots, 20% impervious), existing gravel roads, and open water. The sum of all non-forest land cover is only 3% of the total analysis area under existing conditions. Non-forest land cover was digitized from aerial photography. Gravel road surfaces (not including right-of-way) were assigned a CN of 96 regardless of HSG and noted as 99% impervious in HydroCAD[2].

Soils Data

Overall project soils data was obtained from the Natural Resources Conservation Service (NRCS) Web Soils Survey (http://websoilsurvey.nrcs.usda.gov), including soil map units, soil descriptions, hydrologic soils group (HSGs), and digital soil boundaries on October 16, 2012. Grafton County data are Version 15, Aug. 27, 2012 and Merrimack County data are Version 17, Oct. 27, 2009. Soils information is shown on the color-coded **Pre-Development Soil Plan, (Sheets Pre-2.1 to Pre-2.8).** Hydrologic soil groups are approximately 67 % HSG C, 19% HSG B, 10% HSG D, and 4% HSG A.

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[2] Other curve numbers commonly used to model gravel roads are noted in TR-55 as accounting for an unspecified combination of gravel surface and right-of-way. Existing gravel roads were digitized based on apparent edge of gravel. To model compacted gravel road surfaces only, a custom line with “99% imp” was added to the curve number lookup table. HydroCAD version 9.10 does not appear to support modeling curve numbers less than 98 as 100% impervious, but any error introduced is negligible.

A waiver of rules requiring site specific soil mapping for areas of proposed disturbance (Env-Wq 1504.09 (b) (2) b.) is requested. The proposed areas of disturbance account for a very small percentage of the total 7,100 acre drainage analysis area, and thus the increased precision of soil classification in this relatively small area would not increase the precision of the drainage analysis overall. Refer to the Waiver Request for the formal request language. Site specific soil mapping has been done where infiltration-based stormwater treatment devices will be sited and at the operations and maintenance (O&M) building and substation sites.

Analysis Points and Watershed Delineation

Ten analysis points were chosen to compare pre-project versus post project runoff. Analysis points were chosen to coincide with the Wild Meadows project lease boundaries in locations where a watershed could be defined by concentrated flow crossing the lease boundary, which is the case for watersheds 3, 4, 5, 6, 7, and 10. In other locations where concentrated flow would not occur at the project lease boundary, analysis points were chosen as near as possible to lease boundaries while encompassing all proposed project related disturbance, which is the case for watersheds 1, 2, 8, and 9. This approach seeks to accurately model watershed runoff and avoid problems which may be caused by creating an excessive number of very small watersheds on one hand, or by drawing unnatural watershed boundaries corresponding with lease lines on the other. Inclusion of portions of the watersheds outside the lease lines will not affect the pre- versus post-project flow comparison because no changes in cover conditions or soil types will be modeled outside of the actual project disturbance area.

Pre-project watersheds were delineated using 2-foot contours from processed aerial topography supplemented with ground survey where available, and USGS 20-foot contours where accurate 2-foot topography was not available. The total watershed area is approximately 7,100 acres although only a very small percentage of this land area will be disturbed by project construction.

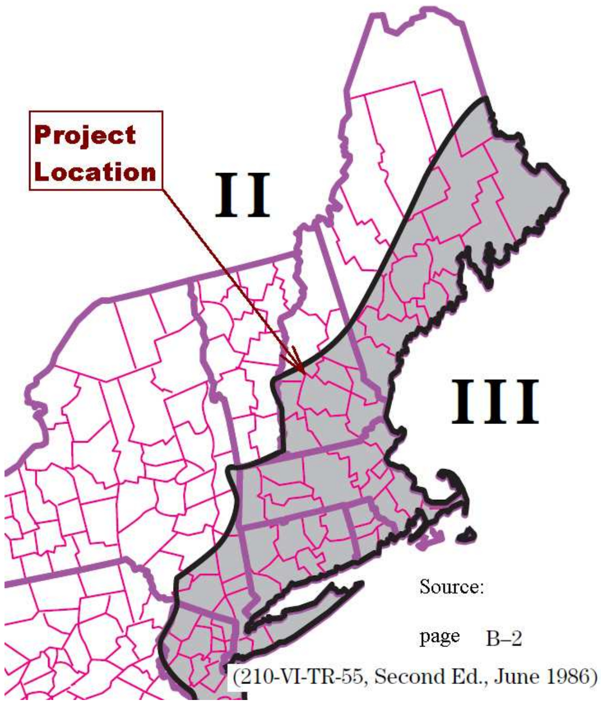
Pre-development watershed boundaries and flow paths are shown on the **Pre-Development Drainage Area Plan .** A waiver of the plan scale and contour interval requirement is requested due to the scale of the project

Time of Concentration

Time of concentration (Tc) used to determine peak flows was calculated by the TR-55 method. Flow paths and slopes were determined from 2-foot contours from processed aerial topography supplemented with ground survey where available, and USGS 20-foot contours where accurate 2-foot topography was not available. Where available, time of concentration lines generally followed delineated streams in preference to other topography. Times of travel were calculated for each segment along the flow path including sheet flow, shallow concentrated flow (overland flow), and channelized flow. Segments are labeled A, B, C, etc. and are identified on the **Pre-Development Drainage Area Plan**. Sheet flow lengths were limited to 100 feet. Trapezoidal channels were assumed for channelized flow, with channel width and depth for lower channels roughly based on bankfull parameters extrapolated from the New Hampshire 2005 Regional Hydraulic Geometry Curves (provisional), which are based on drainage area.

Rainfall Events

Standard NRCS (SCS) 24-hour rainfall events have specific temporal distributions as well as intensities or depths, depending on geographic location. The Wild Meadows project is somewhat unique in that the project is located in two towns in two different counties, (Alexandria in Grafton County and Danbury in Merrimack County). In New Hampshire, NRCS Type III storms are typically used in Merrimack County and Type II storms in Grafton County. Closely examining the Figure B-2 (reproduced below) from NRCS TR-55 (1986), it is apparent that a Type III storm is suitable.



The Alteration of Terrain (AoT) permit requires use of precipitation data available online from the Northeast Regional Climate Center (http://precip.eas.cornell.edu/). Using this tool, precipitation depths for the 24-hour storm were obtained for nine representative locations within the project site. Precipitation amounts only varies by several hundredths of an inch. The most conservative (i.e. highest precipitation) totals were at the Substation location, as noted in the table below. For simplicity, these conservative values will be used project-wide.

	1 yr	2 yr	10 yr	25 yr	50 yr	100 yr
24-hour precipitation (inches)	2.26	2.65	3.85	4.76	5.59	6.58

From: Northeast Regional Climate Center Extreme Precipitation Table, for 43.581 deg N, 71.796 deg W, elev. 637 ft

Based on topography, 10 pre-development drainage areas have been identified on the project site. These drainage areas are designated as Pre#1 thru Pre#10 throughout the drainage analysis and drainage report, as well as in the HydroCAD Model. The total watershed to be analyzed is 7,099 acres.

Drainage area Pre#1 is located on the west side of the project site, the watershed consists of 2,832.7 acres of mostly wooded area, existing roads and residential lots with less than 20% impervious area, with the watershed covering an area in Grafton, Danbury and Alexandria. Stormwater runoff drains south to discharge point AP1, and eventually to the Wild Meadows Brook.

Drainage area Pre#2 is located on the southwest portion of the project and consists of 413.3 acres of all wooded area located in Danbury. Stormwater runoff flows in a southerly direction to Taylor Brook.

Drainage area Pre#3 is located in the center south portion of the project and consists of 226.4 acres of all wooded area also located in Danbury. Stormwater runoff flows in a southerly direction along an intermittent channel to a perennial stream and eventually to the tributaries of Taylor Brook.

Drainage area Pre#4 is located in the south center portion of the project also, and consists of 143.0 acres of all wooded area, located in both Danbury and Alexandria. Stormwater runoff flows in a southerly and westerly direction along an intermittent channel to a perennial stream and eventually to the tributaries of Taylor Brook.

Drainage area Pre#5 can be found on the southeast corner of the project and the watershed consists of 189.3 acres of an all wooded area in both Danbury and Alexandria. Stormwater runoff flows in a southerly direction towards Taylor Brook.

Drainage area Pre#6 can be found on the east side of the project and the watershed area will consist of 244.2 acres of all wooded area located in the town of Alexandria. Stormwater runoff flows in an easterly toward Pine Hill Brook.

Drainage area Pre#7 is also on the east side of the project and located in Alexandria. The watershed consists of 65.30 acres of all wooded area that stormwater runoff flows to the east and off site into an unnamed perennial stream and eventually into Bog Brook.

Drainage area Pre#8 is located in Alexandria on the northeast corner of the site and consists of 367.3 acres of mostly wooded area with some existing gravel roads. Stormwater runoff flows in a northeasterly direction towards Patten Brook.

Drainage area Pre#9 is located in the north center portion of the project site and is located in both Danbury and Alexandria. The watershed consists of 1,025.2 acres of mostly wooded area, with a small unnamed pond located in the center of the watershed area. Stormwater runoff flows in a northerly direction towards the unnamed pond and then in a northeasterly direction towards Patten Brook.

Drainage area Pre#10 is located to the north of the project site and is in Grafton, Alexandria and Danbury and consists of 1,693.0 acres of mostly wooded area, existing roads and residential lots with less than 20% impervious area. Stormwater runoff flows in a southeasterly direction to Patten Brook.

Pre development watersheds associated with the substation and operation and maintenance facility are considered separately and each has their own pre development analysis areas. The watershed areas and drainage paths can be found in **Section 4B and 4C.**

NRCS soils were used in determining Hydrologic Soil Types due to the length/size of the wind turbine access roads, pads and drainage areas and minor changes that would be conferred with a more detailed soils analysis given the limited extent and type of proposed surfaces as a proportion of the watershed area. A field investigation of the existing soils within the work area associated with the proposed substation and operation and maintenance facility has been completed by Ray Lobdell, Certified Soil Scientist, of Lobdell Associates, Inc., in accordance with Env-Wq 1504.09 (b) (2) with mapping completed during November of 2012. This information along with the test pit data can be found in **Section 3.6** of this report.

In general, the soils have been classified as Hydrologic Group C in the eastern part of the project associated with the access roads and turbine pads, and Hydrologic Soil Groups C and D in the west. There are some smaller areas interspersed throughout the access road and turbine portion of the site which are classified as Hydrologic Soil Groups A and B.

A mixture of all hydrologic group soils underlies the substation and Hydrologic Group C and D soils generally underlie the operation and maintenance facility.

For areas within the delineated watershed, but outside the limits of the project work area, NRCS soils mapping and classifications have been used to complete the analysis. This information can be found in **Section 2.10.** The watershed areas and drainage paths can be found in **Section 4A.**

3.3B Pre-Development Analysis (Substation)

3.3B Pre-Development Analysis (Substation)

Based on topography, four pre-development drainage areas have been identified on the project site to accommodate all areas disturbed by the project. Note, no analysis was done on the northeast corner of the site as no new development is proposed on this portion of the site; therefore, there is no change in the pre- versus post-development analysis. The four areas modeled, drain to points designated as AP1, AP2, AP3 and AP4 and can be found throughout the drainage analysis and drainage report, as well as in the HydroCAD Model. The total watershed to be analyzed is 56.66 acres.

Drainage area Pr-1 is located on the southwest of the project site, draining north to south to discharge point AP1, a point near the southerly property line. This drainage area is primarily located on a hillside in an area that is mostly wooded.

Drainage area Pr-2, 3, 4 and 5 are located in the center, and west side of the site. Area Pr2, which discharges to AP2 (the bog area) extends from the bog area at the southern property line to Cass Mill Road along the northwest property line. Drainage area Pr-2 continues uphill on the west side of Cass Mill Road, and consists mostly of wooded uplands with an existing intermittent stream discharging into AP2. Drainage areas Pr3, 4 and 5 are smaller drainage areas that also discharge into AP2 (the bog area along the south and east property line). These areas are a mix of existing gravel roads, excavated pits, and wooded areas. There is an intermittent stream flowing from north to south to the bog area within area PR2. The intent of the model in this area is to show that there will be no increase in flow from the new development to the bog area, and to any offsite areas. AP2 consists of all wetlands that occur at approximate elevation 605.5. Please note, a small portion of these wetlands is separated by the existing gravel road and an existing pile of wood debris near proposed road station 2+00. Although this wetland is separated from the larger bog area by the narrow existing road, the analysis point AP2 includes this area as they are at the same general elevation of 605.5 and are likely connected by the water table.

Drainage area Pr-6 and Pr-7 are located in the northeast corner of the project site, and are mostly wooded with the existing utility easement passing thru them. They both discharge to culverts along Bog Road to the east. The discharge points are AP3 and AP4 respectfully, and no increase in runoff is anticipated as no new development is proposed in these areas. No further analysis points were identified to the north of Pr-7 on the existing parcel and no development is proposed beyond Pr-5.

A field investigation of the existing soils within the work area was completed by Ray Lobdell, Certified Soil Scientist, of Lobdell Associates, Inc., in accordance with Env-Wq 1504.09 (b) (2) in May of 2013. This information, along with the test pit data, can be found in **Section 3.6** of this report. For areas within the delineated watershed, but outside the limits of the project work area, NRCS soils mapping and classifications have been used to complete the analysis. This information can be found in **Section 2.10.** The watershed areas and drainage paths can be found in **Section 4.**

3.3C Pre-Development Analysis (O&M Building)

3.3C Pre-Development Analysis (O&M Building)

Based on a site visit and topography, one analysis point has been identified on the project site to accommodate all areas disturbed by the project. The total watershed to be analyzed is 15.54 acres.

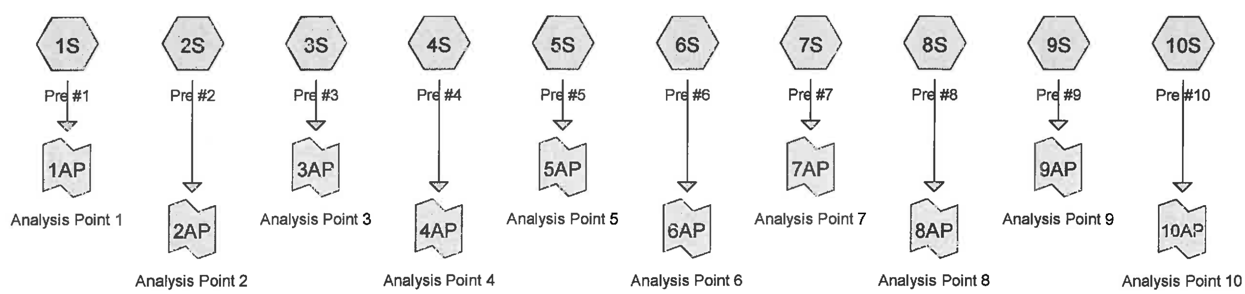
Drainage area Pre 1 is located on the northwest portion of the project site, draining east to west to discharge point AP1, along the easterly edge of Grants Pond. This drainage area includes approximately 50% wooded area, and 50% open field. The proposed operations and maintenance facility and stormwater treatment practices are proposed within the existing field with minimal tree clearing in the area of the filtration pond. This drainage area is bordered by a wetland and drainage channel that runs along the easterly edge of the project site.

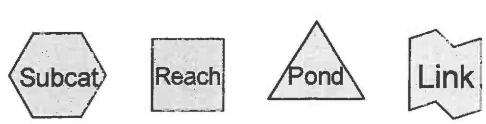
A field investigation of the existing soils within the work area was completed by Ray Lobdell, Certified Soil Scientist, of Lobdell Associates, Inc., in accordance with Env-Wq 1504.09 (b) (2) in May of 2013. This information, along with the test pit data, can be found in **Section 3.6** of this report. For areas within the delineated watershed, but outside the limits of the project work area, NRCS soils mapping and classifications have been used to complete the analysis. This information can be found in **Section 2.10.** The watershed areas and drainage paths can be found in **Section 4.**

3.3.1 Pre-Development Node Listing
2, 10 and 50 - Year Storm Event

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building

A. Overall Project





Drainage Diagram for WM_Drainage_Pre_70percent
Prepared by Microsoft, Printed 11/12/2013
HydroCAD® 9.10 s/n 05478 © 2010 HydroCAD Software Solutions LLC

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre #1 Runoff Area=123,391,731 sf 1.44% Impervious Runoff Depth=0.46"
Flow Length=22,576' Tc=67.2 min CN=68 Runoff=421.3 cfs 107.457 af

Subcatchment 2S: Pre #2 Runoff Area=18,001,351 sf 0.00% Impervious Runoff Depth=0.42"
Flow Length=6,178' Tc=34.2 min CN=67 Runoff=79.7 cfs 14.485 af

Subcatchment 3S: Pre #3 Runoff Area=9,863,544 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=3,912' Tc=45.0 min CN=47 Runoff=0.4 cfs 0.252 af

Subcatchment 4S: Pre #4 Runoff Area=6,185,727 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=5,139' Tc=27.7 min CN=51 Runoff=1.0 cfs 0.607 af

Subcatchment 5S: Pre #5 Runoff Area=8,243,778 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=6,203' Tc=26.0 min CN=55 Runoff=3.3 cfs 1.762 af

Subcatchment 6S: Pre #6 Runoff Area=10,637,566 sf 0.00% Impervious Runoff Depth=0.53"
Flow Length=6,975' Tc=33.0 min CN=70 Runoff=66.9 cfs 10.761 af

Subcatchment 7S: Pre #7 Runoff Area=2,844,409 sf 0.00% Impervious Runoff Depth=0.53"
Flow Length=3,296' Tc=29.5 min CN=70 Runoff=18.8 cfs 2.877 af

Subcatchment 8S: Pre #8 Runoff Area=11,643,693 sf 0.18% Impervious Runoff Depth=0.53"
Flow Length=7,738' Tc=31.7 min CN=70 Runoff=74.7 cfs 11.779 af

Subcatchment 9S: Pre #9 Runoff Area=44,657,988 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=7,938' Tc=39.8 min CN=69 Runoff=230.9 cfs 41.971 af

Subcatchment 10S: Pre #10 Runoff Area=73,747,482 sf 1.31% Impervious Runoff Depth=0.42"
Flow Length=17,365' Tc=45.8 min CN=67 Runoff=281.4 cfs 59.342 af

Link 1AP: Analysis Point 1 Inflow=421.3 cfs 107.457 af
Primary=421.3 cfs 107.457 af

Link 2AP: Analysis Point 2 Inflow=79.7 cfs 14.485 af
Primary=79.7 cfs 14.485 af

Link 3AP: Analysis Point 3 Inflow=0.4 cfs 0.252 af
Primary=0.4 cfs 0.252 af

Link 4AP: Analysis Point 4 Inflow=1.0 cfs 0.607 af
Primary=1.0 cfs 0.607 af

Link 5AP: Analysis Point 5 Inflow=3.3 cfs 1.762 af
Primary=3.3 cfs 1.762 af

Link 6AP: Analysis Point 6 Inflow=66.9 cfs 10.761 af
Primary=66.9 cfs 10.761 af

Link 7AP: Analysis Point 7	Inflow=18.8 cfs 2.877 af Primary=18.8 cfs 2.877 af
Link 8AP: Analysis Point 8	Inflow=74.7 cfs 11.779 af Primary=74.7 cfs 11.779 af
Link 9AP: Analysis Point 9	Inflow=230.9 cfs 41.971 af Primary=230.9 cfs 41.971 af
Link 10AP: Analysis Point 10	Inflow=281.4 cfs 59.342 af Primary=281.4 cfs 59.342 af

Total Runoff Area = 7,098.65 ac Runoff Volume = 251.294 af Average Runoff Depth = 0.42"
99.11% Pervious = 7,035.37 ac 0.89% Impervious = 63.28 ac

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre #1 Runoff Area=123,391,731 sf 1.44% Impervious Runoff Depth=1.11"
Flow Length=22,576' Tc=67.2 min CN=68 Runoff=1,234.2 cfs 262.300 af

Subcatchment 2S: Pre #2 Runoff Area=18,001,351 sf 0.00% Impervious Runoff Depth=1.05"
Flow Length=6,178' Tc=34.2 min CN=67 Runoff=246.5 cfs 36.283 af

Subcatchment 3S: Pre #3 Runoff Area=9,863,544 sf 0.00% Impervious Runoff Depth=0.20"
Flow Length=3,912' Tc=45.0 min CN=47 Runoff=7.6 cfs 3.728 af

Subcatchment 4S: Pre #4 Runoff Area=6,185,727 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=5,139' Tc=27.7 min CN=51 Runoff=15.0 cfs 3.815 af

Subcatchment 5S: Pre #5 Runoff Area=8,243,778 sf 0.00% Impervious Runoff Depth=0.47"
Flow Length=6,203' Tc=26.0 min CN=55 Runoff=39.3 cfs 7.434 af

Subcatchment 6S: Pre #6 Runoff Area=10,637,566 sf 0.00% Impervious Runoff Depth=1.23"
Flow Length=6,975' Tc=33.0 min CN=70 Runoff=179.4 cfs 25.044 af

Subcatchment 7S: Pre #7 Runoff Area=2,844,409 sf 0.00% Impervious Runoff Depth=1.23"
Flow Length=3,296' Tc=29.5 min CN=70 Runoff=50.5 cfs 6.697 af

Subcatchment 8S: Pre #8 Runoff Area=11,643,693 sf 0.18% Impervious Runoff Depth=1.23"
Flow Length=7,738' Tc=31.7 min CN=70 Runoff=200.1 cfs 27.412 af

Subcatchment 9S: Pre #9 Runoff Area=44,657,988 sf 0.00% Impervious Runoff Depth=1.17"
Flow Length=7,938' Tc=39.8 min CN=69 Runoff=646.6 cfs 99.973 af

Subcatchment 10S: Pre #10 Runoff Area=73,747,482 sf 1.31% Impervious Runoff Depth=1.05"
Flow Length=17,365' Tc=45.8 min CN=67 Runoff=869.0 cfs 148.645 af

Link 1AP: Analysis Point 1 Inflow=1,234.2 cfs 262.300 af
Primary=1,234.2 cfs 262.300 af

Link 2AP: Analysis Point 2 Inflow=246.5 cfs 36.283 af
Primary=246.5 cfs 36.283 af

Link 3AP: Analysis Point 3 Inflow=7.6 cfs 3.728 af
Primary=7.6 cfs 3.728 af

Link 4AP: Analysis Point 4 Inflow=15.0 cfs 3.815 af
Primary=15.0 cfs 3.815 af

Link 5AP: Analysis Point 5 Inflow=39.3 cfs 7.434 af
Primary=39.3 cfs 7.434 af

Link 6AP: Analysis Point 6 Inflow=179.4 cfs 25.044 af
Primary=179.4 cfs 25.044 af

Link 7AP: Analysis Point 7
Inflow=50.5 cfs 6.697 af
Primary=50.5 cfs 6.697 af

Link 8AP: Analysis Point 8
Inflow=200.1 cfs 27.412 af
Primary=200.1 cfs 27.412 af

Link 9AP: Analysis Point 9
Inflow=646.6 cfs 99.973 af
Primary=646.6 cfs 99.973 af

Link 10AP: Analysis Point 10
Inflow=869.0 cfs 148.645 af
Primary=869.0 cfs 148.645 af

Total Runoff Area = 7,098.65 ac Runoff Volume = 621.331 af Average Runoff Depth = 1.05"
99.11% Pervious = 7,035.37 ac 0.89% Impervious = 63.28 ac

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre #1 Runoff Area=123,391,731 sf 1.44% Impervious Runoff Depth=2.31"
Flow Length=22,576' Tc=67.2 min CN=68 Runoff=2,751.5 cfs 545.347 af

Subcatchment 2S: Pre #2 Runoff Area=18,001,351 sf 0.00% Impervious Runoff Depth=2.23"
Flow Length=6,178' Tc=34.2 min CN=67 Runoff=559.3 cfs 76.626 af

Subcatchment 3S: Pre #3 Runoff Area=9,863,544 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=3,912' Tc=45.0 min CN=47 Runoff=63.3 cfs 14.361 af

Subcatchment 4S: Pre #4 Runoff Area=6,185,727 sf 0.00% Impervious Runoff Depth=1.01"
Flow Length=5,139' Tc=27.7 min CN=51 Runoff=77.1 cfs 11.995 af

Subcatchment 5S: Pre #5 Runoff Area=8,243,778 sf 0.00% Impervious Runoff Depth=1.29"
Flow Length=6,203' Tc=26.0 min CN=55 Runoff=147.9 cfs 20.314 af

Subcatchment 6S: Pre #6 Runoff Area=10,637,566 sf 0.00% Impervious Runoff Depth=2.48"
Flow Length=6,975' Tc=33.0 min CN=70 Runoff=379.5 cfs 50.545 af

Subcatchment 7S: Pre #7 Runoff Area=2,844,409 sf 0.00% Impervious Runoff Depth=2.48"
Flow Length=3,296' Tc=29.5 min CN=70 Runoff=106.8 cfs 13.515 af

Subcatchment 8S: Pre #8 Runoff Area=11,643,693 sf 0.18% Impervious Runoff Depth=2.48"
Flow Length=7,738' Tc=31.7 min CN=70 Runoff=423.8 cfs 55.326 af

Subcatchment 9S: Pre #9 Runoff Area=44,657,988 sf 0.00% Impervious Runoff Depth=2.40"
Flow Length=7,938' Tc=39.8 min CN=69 Runoff=1,397.8 cfs 204.740 af

Subcatchment 10S: Pre #10 Runoff Area=73,747,482 sf 1.31% Impervious Runoff Depth=2.23"
Flow Length=17,365' Tc=45.8 min CN=67 Runoff=1,973.8 cfs 313.918 af

Link 1AP: Analysis Point 1 Inflow=2,751.5 cfs 545.347 af
Primary=2,751.5 cfs 545.347 af

Link 2AP: Analysis Point 2 Inflow=559.3 cfs 76.626 af
Primary=559.3 cfs 76.626 af

Link 3AP: Analysis Point 3 Inflow=63.3 cfs 14.361 af
Primary=63.3 cfs 14.361 af

Link 4AP: Analysis Point 4 Inflow=77.1 cfs 11.995 af
Primary=77.1 cfs 11.995 af

Link 5AP: Analysis Point 5 Inflow=147.9 cfs 20.314 af
Primary=147.9 cfs 20.314 af

Link 6AP: Analysis Point 6 Inflow=379.5 cfs 50.545 af
Primary=379.5 cfs 50.545 af

Link 7AP: Analysis Point 7

Inflow=106.8 cfs 13.515 af
Primary=106.8 cfs 13.515 af

Link 8AP: Analysis Point 8

Inflow=423.8 cfs 55.326 af
Primary=423.8 cfs 55.326 af

Link 9AP: Analysis Point 9

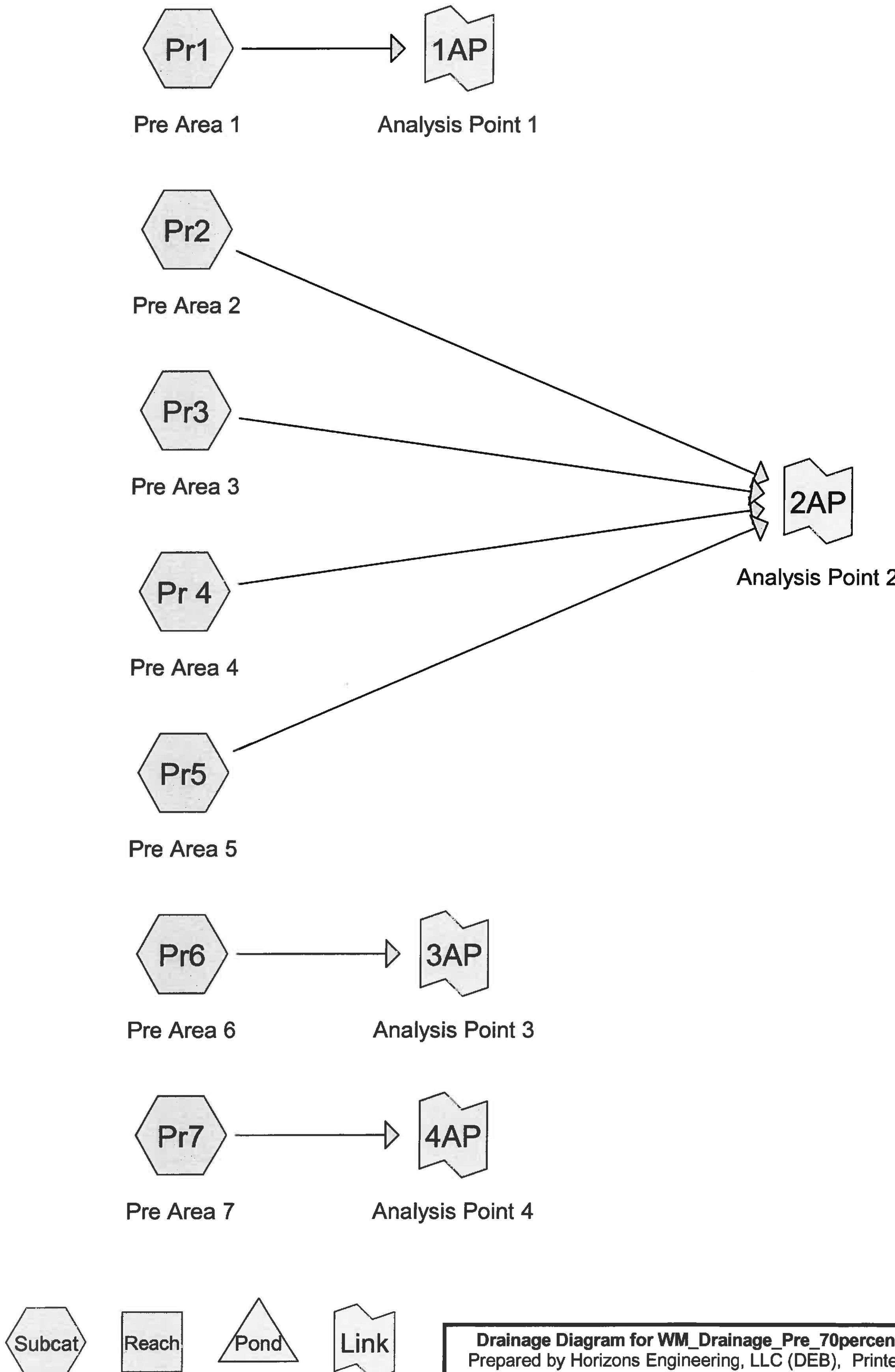
Inflow=1,397.8 cfs 204.740 af
Primary=1,397.8 cfs 204.740 af

Link 10AP: Analysis Point 10

Inflow=1,973.8 cfs 313.918 af
Primary=1,973.8 cfs 313.918 af

Total Runoff Area = 7,098.65 ac Runoff Volume = 1,306.688 af Average Runoff Depth = 2.21"
99.11% Pervious = 7,035.37 ac 0.89% Impervious = 63.28 ac

B. Substation Interconnection Station



Drainage Diagram for WM_Drainage_Pre_70percent substation
Prepared by Horizons Engineering, LLC (DEB), Printed 10/28/2013
HydroCAD® 9.10 s/n 02765 © 2010 HydroCAD Software Solutions LLC

Project Notes

24-hour rainfall from Northeast Regional Climate Center, 71.796 deg W, 43.581 deg N, elev. 637 ft (Substation location, most conservative)

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Pr 4: Pre Area 4 Runoff Area=2.34 ac 0.00% Impervious Runoff Depth=0.39"
Flow Length=533' Tc=28.0 min CN=66 Runoff=0.43 cfs 0.076 af

Subcatchment Pr1: Pre Area 1 Runoff Area=10.96 ac 0.00% Impervious Runoff Depth=0.53"
Flow Length=945' Tc=21.5 min CN=70 Runoff=3.58 cfs 0.483 af

Subcatchment Pr2: Pre Area 2 Runoff Area=33.26 ac 0.81% Impervious Runoff Depth=0.57"
Flow Length=3,835' Tc=28.0 min CN=71 Runoff=10.84 cfs 1.574 af

Subcatchment Pr3: Pre Area 3 Runoff Area=1.81 ac 2.76% Impervious Runoff Depth=0.39"
Flow Length=395' Tc=11.6 min CN=66 Runoff=0.44 cfs 0.058 af

Subcatchment Pr5: Pre Area 5 Runoff Area=0.81 ac 8.64% Impervious Runoff Depth=0.46"
Flow Length=225' Slope=0.0200 '/' Tc=26.5 min CN=68 Runoff=0.20 cfs 0.031 af

Subcatchment Pr6: Pre Area 6 Runoff Area=5.11 ac 0.00% Impervious Runoff Depth=0.30"
Flow Length=1,120' Tc=20.3 min CN=63 Runoff=0.68 cfs 0.126 af

Subcatchment Pr7: Pre Area 7 Runoff Area=2.37 ac 0.00% Impervious Runoff Depth=0.36"
Flow Length=511' Tc=11.1 min CN=65 Runoff=0.50 cfs 0.070 af

Link 1AP: Analysis Point 1 Inflow=3.58 cfs 0.483 af
Primary=3.58 cfs 0.483 af

Link 2AP: Analysis Point 2 Inflow=11.79 cfs 1.739 af
Primary=11.79 cfs 1.739 af

Link 3AP: Analysis Point 3 Inflow=0.68 cfs 0.126 af
Primary=0.68 cfs 0.126 af

Link 4AP: Analysis Point 4 Inflow=0.50 cfs 0.070 af
Primary=0.50 cfs 0.070 af

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Pr 4: Pre Area 4 Runoff Area=2.34 ac 0.00% Impervious Runoff Depth=1.00"
Flow Length=533' Tc=28.0 min CN=66 Runoff=1.43 cfs 0.194 af

Subcatchment Pr1: Pre Area 1 Runoff Area=10.96 ac 0.00% Impervious Runoff Depth=1.23"
Flow Length=945' Tc=21.5 min CN=70 Runoff=9.70 cfs 1.124 af

Subcatchment Pr2: Pre Area 2 Runoff Area=33.26 ac 0.81% Impervious Runoff Depth=1.29"
Flow Length=3,835' Tc=28.0 min CN=71 Runoff=27.95 cfs 3.582 af

Subcatchment Pr3: Pre Area 3 Runoff Area=1.81 ac 2.76% Impervious Runoff Depth=1.00"
Flow Length=395' Tc=11.6 min CN=66 Runoff=1.56 cfs 0.150 af

Subcatchment Pr5: Pre Area 5 Runoff Area=0.81 ac 8.64% Impervious Runoff Depth=1.11"
Flow Length=225' Slope=0.0200 '/' Tc=26.5 min CN=68 Runoff=0.58 cfs 0.075 af

Subcatchment Pr6: Pre Area 6 Runoff Area=5.11 ac 0.00% Impervious Runoff Depth=0.84"
Flow Length=1,120' Tc=20.3 min CN=63 Runoff=2.81 cfs 0.357 af

Subcatchment Pr7: Pre Area 7 Runoff Area=2.37 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=511' Tc=11.1 min CN=65 Runoff=1.92 cfs 0.186 af

Link 1AP: Analysis Point 1 Inflow=9.70 cfs 1.124 af
Primary=9.70 cfs 1.124 af

Link 2AP: Analysis Point 2 Inflow=30.92 cfs 4.002 af
Primary=30.92 cfs 4.002 af

Link 3AP: Analysis Point 3 Inflow=2.81 cfs 0.357 af
Primary=2.81 cfs 0.357 af

Link 4AP: Analysis Point 4 Inflow=1.92 cfs 0.186 af
Primary=1.92 cfs 0.186 af

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Pr 4: Pre Area 4 Runoff Area=2.34 ac 0.00% Impervious Runoff Depth=2.14"
Flow Length=533' Tc=28.0 min CN=66 Runoff=3.33 cfs 0.417 af

Subcatchment Pr1: Pre Area 1 Runoff Area=10.96 ac 0.00% Impervious Runoff Depth=2.48"
Flow Length=945' Tc=21.5 min CN=70 Runoff=20.64 cfs 2.268 af

Subcatchment Pr2: Pre Area 2 Runoff Area=33.26 ac 0.81% Impervious Runoff Depth=2.57"
Flow Length=3,835' Tc=28.0 min CN=71 Runoff=57.98 cfs 7.129 af

Subcatchment Pr3: Pre Area 3 Runoff Area=1.81 ac 2.76% Impervious Runoff Depth=2.14"
Flow Length=395' Tc=11.6 min CN=66 Runoff=3.66 cfs 0.323 af

Subcatchment Pr5: Pre Area 5 Runoff Area=0.81 ac 8.64% Impervious Runoff Depth=2.31"
Flow Length=225' Slope=0.0200 '/' Tc=26.5 min CN=68 Runoff=1.29 cfs 0.156 af

Subcatchment Pr6: Pre Area 6 Runoff Area=5.11 ac 0.00% Impervious Runoff Depth=1.89"
Flow Length=1,120' Tc=20.3 min CN=63 Runoff=7.22 cfs 0.807 af

Subcatchment Pr7: Pre Area 7 Runoff Area=2.37 ac 0.00% Impervious Runoff Depth=2.06"
Flow Length=511' Tc=11.1 min CN=65 Runoff=4.65 cfs 0.406 af

Link 1AP: Analysis Point 1 Inflow=20.64 cfs 2.268 af
Primary=20.64 cfs 2.268 af

Link 2AP: Analysis Point 2 Inflow=64.66 cfs 8.025 af
Primary=64.66 cfs 8.025 af

Link 3AP: Analysis Point 3 Inflow=7.22 cfs 0.807 af
Primary=7.22 cfs 0.807 af

Link 4AP: Analysis Point 4 Inflow=4.65 cfs 0.406 af
Primary=4.65 cfs 0.406 af

C. Operation and Maintenance Building

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: Post #1.1 Runoff Area=1.94 ac 1.55% Impervious Runoff Depth=1.37"
Flow Length=359' Tc=2.5 min CN=86 Runoff=3.4 cfs 0.221 af

Subcatchment 1.2: Post #1.2 Runoff Area=2.35 ac 2.13% Impervious Runoff Depth=0.99"
Flow Length=553' Tc=18.9 min CN=80 Runoff=1.8 cfs 0.195 af

Subcatchment 1.3: Post #1.3 Runoff Area=0.36 ac 0.00% Impervious Runoff Depth=0.79"
Flow Length=334' Tc=1.2 min CN=76 Runoff=0.3 cfs 0.024 af

Subcatchment 1.4: Post #1.4 Runoff Area=9.05 ac 0.00% Impervious Runoff Depth=0.65"
Flow Length=960' Tc=29.3 min CN=73 Runoff=3.5 cfs 0.491 af

Reach 2R: Reach Avg. Flow Depth=0.05' Max Vel=0.64 fps Inflow=0.3 cfs 0.045 af
n=0.040 L=612.0' S=0.0163 '/' Capacity=181.6 cfs Outflow=0.3 cfs 0.045 af

Reach R1: Reach Avg. Flow Depth=0.25' Max Vel=2.79 fps Inflow=1.5 cfs 0.195 af
n=0.040 L=186.0' S=0.0457 '/' Capacity=45.3 cfs Outflow=1.5 cfs 0.195 af

Pond P1: Filtration Pond Peak Elev=1,355.66' Storage=9,196 cf Inflow=3.9 cfs 0.439 af
Discarded=0.3 cfs 0.394 af Primary=0.3 cfs 0.045 af Secondary=0.0 cfs 0.000 af Outflow=0.5 cfs 0.439 af

Pond WMAC-1.0: WMAC-1.0 Peak Elev=1,357.62' Storage=362 cf Inflow=3.4 cfs 0.221 af
15.0" Round Culvert n=0.015 L=88.0' S=0.0057 '/' Outflow=3.2 cfs 0.221 af

Pond WMAC-2.0: WMAC-2.0 Peak Elev=1,363.09' Storage=856 cf Inflow=1.8 cfs 0.195 af
15.0" Round Culvert n=0.015 L=70.0' S=0.0214 '/' Outflow=1.5 cfs 0.195 af

Link 1AP: Analysis Point 1 Inflow=3.5 cfs 0.536 af
Primary=3.5 cfs 0.536 af

Total Runoff Area = 13.70 ac Runoff Volume = 0.930 af Average Runoff Depth = 0.81"
99.42% Pervious = 13.62 ac 0.58% Impervious = 0.08 ac

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: Post #1.1 Runoff Area=1.94 ac 1.55% Impervious Runoff Depth=2.41"
Flow Length=359' Tc=2.5 min CN=86 Runoff=6.0 cfs 0.390 af

Subcatchment 1.2: Post #1.2 Runoff Area=2.35 ac 2.13% Impervious Runoff Depth=1.92"
Flow Length=553' Tc=18.9 min CN=80 Runoff=3.6 cfs 0.376 af

Subcatchment 1.3: Post #1.3 Runoff Area=0.36 ac 0.00% Impervious Runoff Depth=1.62"
Flow Length=334' Tc=1.2 min CN=76 Runoff=0.7 cfs 0.049 af

Subcatchment 1.4: Post #1.4 Runoff Area=9.05 ac 0.00% Impervious Runoff Depth=1.42"
Flow Length=960' Tc=29.3 min CN=73 Runoff=8.3 cfs 1.071 af

Reach 2R: Reach Avg. Flow Depth=0.17' Max Vel=1.41 fps Inflow=2.3 cfs 0.339 af
n=0.040 L=612.0' S=0.0163 '/' Capacity=181.6 cfs Outflow=2.1 cfs 0.339 af

Reach R1: Reach Avg. Flow Depth=0.38' Max Vel=3.48 fps Inflow=2.9 cfs 0.376 af
n=0.040 L=186.0' S=0.0457 '/' Capacity=45.3 cfs Outflow=2.9 cfs 0.376 af

Pond P1: Filtration Pond Peak Elev=1,356.64' Storage=14,246 cf Inflow=6.6 cfs 0.814 af
Discarded=0.3 cfs 0.476 af Primary=1.0 cfs 0.291 af Secondary=1.3 cfs 0.047 af Outflow=2.6 cfs 0.814 af

Pond WMAC-1.0: WMAC-1.0 Peak Elev=1,358.37' Storage=693 cf Inflow=6.0 cfs 0.390 af
15.0" Round Culvert n=0.015 L=88.0' S=0.0057 '/' Outflow=5.0 cfs 0.390 af

Pond WMAC-2.0: WMAC-2.0 Peak Elev=1,363.37' Storage=1,794 cf Inflow=3.6 cfs 0.376 af
15.0" Round Culvert n=0.015 L=70.0' S=0.0214 '/' Outflow=2.9 cfs 0.376 af

Link 1AP: Analysis Point 1 Inflow=8.5 cfs 1.410 af
Primary=8.5 cfs 1.410 af

Total Runoff Area = 13.70 ac Runoff Volume = 1.886 af Average Runoff Depth = 1.65"
99.42% Pervious = 13.62 ac 0.58% Impervious = 0.08 ac

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: Post #1.1 Runoff Area=1.94 ac 1.55% Impervious Runoff Depth=4.02"
Flow Length=359' Tc=2.5 min CN=86 Runoff=9.8 cfs 0.650 af

Subcatchment 1.2: Post #1.2 Runoff Area=2.35 ac 2.13% Impervious Runoff Depth=3.41"
Flow Length=553' Tc=18.9 min CN=80 Runoff=6.5 cfs 0.668 af

Subcatchment 1.3: Post #1.3 Runoff Area=0.36 ac 0.00% Impervious Runoff Depth=3.03"
Flow Length=334' Tc=1.2 min CN=76 Runoff=1.4 cfs 0.091 af

Subcatchment 1.4: Post #1.4 Runoff Area=9.05 ac 0.00% Impervious Runoff Depth=2.75"
Flow Length=960' Tc=29.3 min CN=73 Runoff=16.6 cfs 2.075 af

Reach 2R: Reach Avg. Flow Depth=0.38' Max Vel=2.24 fps Inflow=8.7 cfs 0.866 af
n=0.040 L=612.0' S=0.0163 '/' Capacity=181.6 cfs Outflow=8.1 cfs 0.866 af

Reach R1: Reach Avg. Flow Depth=0.51' Max Vel=4.06 fps Inflow=4.7 cfs 0.668 af
n=0.040 L=186.0' S=0.0457 '/' Capacity=45.3 cfs Outflow=4.7 cfs 0.668 af

Pond P1: Filtration Pond Peak Elev=1,356.94' Storage=16,080 cf Inflow=9.9 cfs 1.409 af
Discarded=0.4 cfs 0.543 af Primary=1.1 cfs 0.448 af Secondary=7.5 cfs 0.418 af Outflow=9.0 cfs 1.409 af

Pond WMAC-1.0: WMAC-1.0 Peak Elev=1,359.28' Storage=1,711 cf Inflow=9.8 cfs 0.650 af
15.0" Round Culvert n=0.015 L=88.0' S=0.0057 '/' Outflow=6.8 cfs 0.650 af

Pond WMAC-2.0: WMAC-2.0 Peak Elev=1,363.74' Storage=3,625 cf Inflow=6.5 cfs 0.668 af
15.0" Round Culvert n=0.015 L=70.0' S=0.0214 '/' Outflow=4.7 cfs 0.668 af

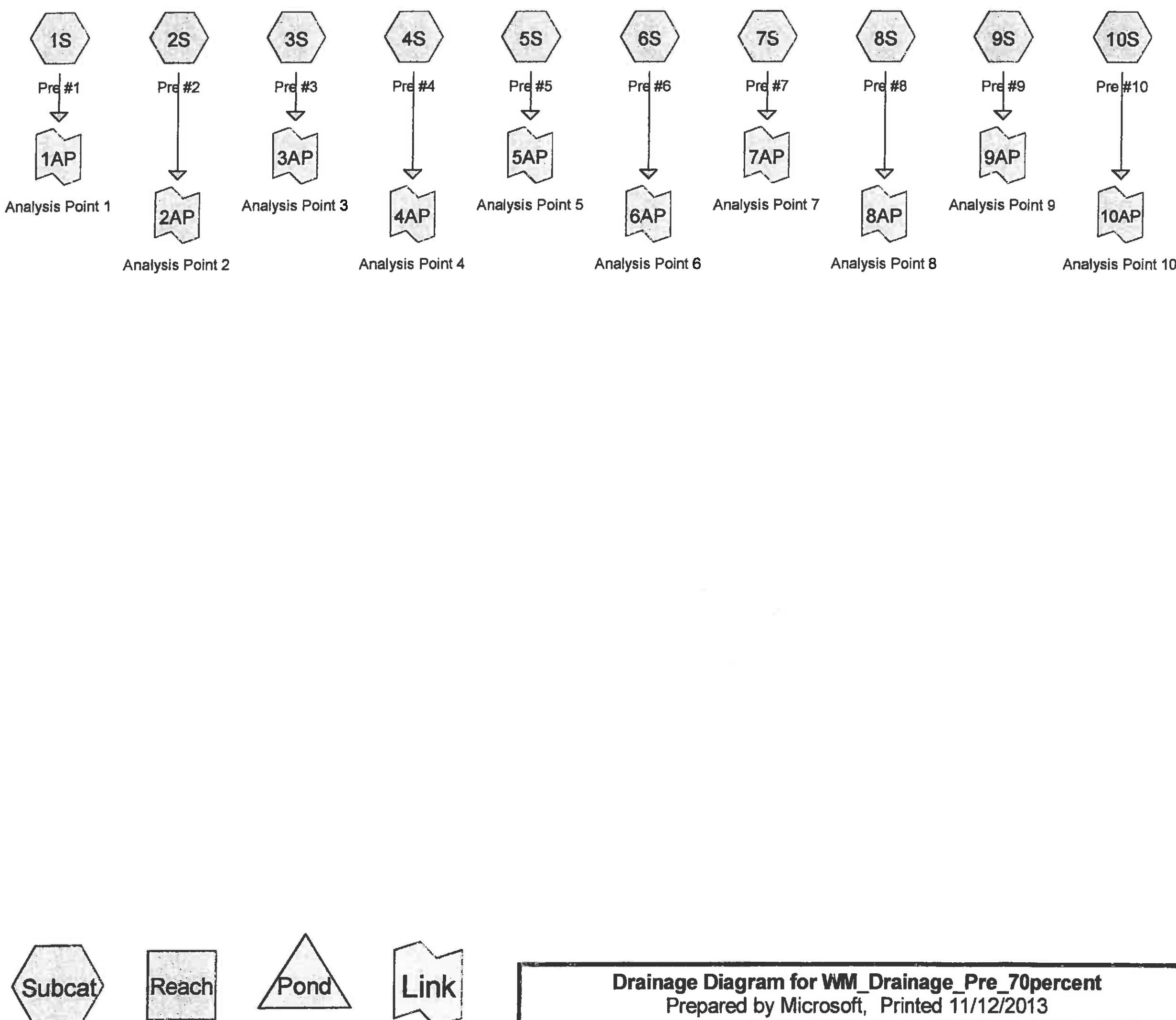
Link 1AP: Analysis Point 1 Inflow=24.6 cfs 2.941 af
Primary=24.6 cfs 2.941 af

Total Runoff Area = 13.70 ac Runoff Volume = 3.485 af Average Runoff Depth = 3.05"
99.42% Pervious = 13.62 ac 0.58% Impervious = 0.08 ac

3.3.2 Pre-Development Full Summary and Diagram
10 - Year Storm Event

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building

A. Overall Project



Drainage Diagram for WM_Drainage_Pre_70percent
Prepared by Microsoft, Printed 11/12/2013
HydroCAD® 9.10 s/n 05478 © 2010 HydroCAD Software Solutions LLC

Project Notes

24-hour rainfall from Northeast Regional Climate Center, 71.796 deg W, 43.581 deg N, elev. 637 ft (Substation location, most conservative)

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.58	30	Meadow, non-grazed, HSG A (1S)
283.70	30	Woods, Good, HSG A (1S, 3S, 4S, 5S, 9S, 10S)
1.02	51	1 acre lots, 20% imp, HSG A (1S)
1,255.35	55	Woods, Good, HSG B (1S, 2S, 3S, 4S, 5S, 9S, 10S)
22.38	58	Meadow, non-grazed, HSG B (1S, 10S)
29.10	68	1 acre lots, 20% imp, HSG B (1S, 10S)
4,613.37	70	Woods, Good, HSG C (1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S, 10S)
36.37	71	Meadow, non-grazed, HSG C (1S, 10S)
718.65	77	Woods, Good, HSG D (1S, 2S, 3S, 4S, 5S, 9S, 10S)
0.37	78	Meadow, non-grazed, HSG D (1S)
62.01	79	1 acre lots, 20% imp, HSG C (1S, 10S)
1.08	96	Gravel Road Surface, 99% imp, HSG A (1S)
16.45	96	Gravel Road Surface, 99% imp, HSG B (1S, 10S)
27.19	96	Gravel Road Surface, 99% imp, HSG C (1S, 8S, 10S)
0.59	96	Gravel Road Surface, 99% imp, HSG D (1S)
28.44	98	Water Surface, 0% imp, HSG D (1S, 9S)
7,098.65	67	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
288.38	HSG A	1S, 3S, 4S, 5S, 9S, 10S
1,323.27	HSG B	1S, 2S, 3S, 4S, 5S, 9S, 10S
4,738.94	HSG C	1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S, 10S
748.05	HSG D	1S, 2S, 3S, 4S, 5S, 9S, 10S
0.00	Other	
7,098.65		**TOTAL AREA**

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre #1 Runoff Area=123,391,731 sf 1.44% Impervious Runoff Depth=1.11"
Flow Length=22,576' Tc=67.2 min CN=68 Runoff=1,234.2 cfs 262.300 af

Subcatchment 2S: Pre #2 Runoff Area=18,001,351 sf 0.00% Impervious Runoff Depth=1.05"
Flow Length=6,178' Tc=34.2 min CN=67 Runoff=246.5 cfs 36.283 af

Subcatchment 3S: Pre #3 Runoff Area=9,863,544 sf 0.00% Impervious Runoff Depth=0.20"
Flow Length=3,912' Tc=45.0 min CN=47 Runoff=7.6 cfs 3.728 af

Subcatchment 4S: Pre #4 Runoff Area=6,185,727 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=5,139' Tc=27.7 min CN=51 Runoff=15.0 cfs 3.815 af

Subcatchment 5S: Pre #5 Runoff Area=8,243,778 sf 0.00% Impervious Runoff Depth=0.47"
Flow Length=6,203' Tc=26.0 min CN=55 Runoff=39.3 cfs 7.434 af

Subcatchment 6S: Pre #6 Runoff Area=10,637,566 sf 0.00% Impervious Runoff Depth=1.23"
Flow Length=6,975' Tc=33.0 min CN=70 Runoff=179.4 cfs 25.044 af

Subcatchment 7S: Pre #7 Runoff Area=2,844,409 sf 0.00% Impervious Runoff Depth=1.23"
Flow Length=3,296' Tc=29.5 min CN=70 Runoff=50.5 cfs 6.697 af

Subcatchment 8S: Pre #8 Runoff Area=11,643,693 sf 0.18% Impervious Runoff Depth=1.23"
Flow Length=7,738' Tc=31.7 min CN=70 Runoff=200.1 cfs 27.412 af

Subcatchment 9S: Pre #9 Runoff Area=44,657,988 sf 0.00% Impervious Runoff Depth=1.17"
Flow Length=7,938' Tc=39.8 min CN=69 Runoff=646.6 cfs 99.973 af

Subcatchment 10S: Pre #10 Runoff Area=73,747,482 sf 1.31% Impervious Runoff Depth=1.05"
Flow Length=17,365' Tc=45.8 min CN=67 Runoff=869.0 cfs 148.645 af

Link 1AP: Analysis Point 1 Inflow=1,234.2 cfs 262.300 af
Primary=1,234.2 cfs 262.300 af

Link 2AP: Analysis Point 2 Inflow=246.5 cfs 36.283 af
Primary=246.5 cfs 36.283 af

Link 3AP: Analysis Point 3 Inflow=7.6 cfs 3.728 af
Primary=7.6 cfs 3.728 af

Link 4AP: Analysis Point 4 Inflow=15.0 cfs 3.815 af
Primary=15.0 cfs 3.815 af

Link 5AP: Analysis Point 5 Inflow=39.3 cfs 7.434 af
Primary=39.3 cfs 7.434 af

Link 6AP: Analysis Point 6 Inflow=179.4 cfs 25.044 af
Primary=179.4 cfs 25.044 af

Link 7AP: Analysis Point 7
Inflow=50.5 cfs 6.697 af
Primary=50.5 cfs 6.697 af

Link 8AP: Analysis Point 8
Inflow=200.1 cfs 27.412 af
Primary=200.1 cfs 27.412 af

Link 9AP: Analysis Point 9
Inflow=646.6 cfs 99.973 af
Primary=646.6 cfs 99.973 af

Link 10AP: Analysis Point 10
Inflow=869.0 cfs 148.645 af
Primary=869.0 cfs 148.645 af

Total Runoff Area = 7,098.65 ac Runoff Volume = 621.331 af Average Runoff Depth = 1.05"
99.11% Pervious = 7,035.37 ac 0.89% Impervious = 63.28 ac

Summary for Subcatchment 1S: Pre #1

Runoff = 1,234.2 cfs @ 12.98 hrs, Volume= 262.300 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
46,982	96	Gravel Road Surface, 99% imp, HSG A
112,481	30	Meadow, non-grazed, HSG A
44,514	51	1 acre lots, 20% imp, HSG A
1,650,980	30	Woods, Good, HSG A
527,846	96	Gravel Road Surface, 99% imp, HSG B
814,537	58	Meadow, non-grazed, HSG B
398,073	68	1 acre lots, 20% imp, HSG B
18,567,290	55	Woods, Good, HSG B
844,537	96	Gravel Road Surface, 99% imp, HSG C
1,336,187	71	Meadow, non-grazed, HSG C
1,267,442	79	1 acre lots, 20% imp, HSG C
84,761,644	70	Woods, Good, HSG C
25,772	96	Gravel Road Surface, 99% imp, HSG D
16,152	78	Meadow, non-grazed, HSG D
12,148,995	77	Woods, Good, HSG D
828,299	98	Water Surface, 0% imp, HSG D
123,391,731	68	Weighted Average
121,619,040		98.56% Pervious Area
1,772,691		1.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	100	0.0200	0.07		**Sheet Flow, Sheet Flow 1A** Woods: Light underbrush n= 0.400 P2= 2.65"
10.6	1,058	0.1110	1.67		**Shallow Concentrated Flow, Shallow Conc. 1B** Woodland Kv= 5.0 fps
9.6	5,470	0.0710	9.54	106.68	**Trap/Vee/Rect Channel Flow, Channel Flow 1C** Bot.W=6.00' D=1.30' Z= 2.0 '/' Top.W=11.20' n= 0.040
12.3	7,953	0.0370	10.81	210.99	**Trap/Vee/Rect Channel Flow, Channel Flow 1D** Bot.W=9.00' D=1.60' Z= 2.0 '/' Top.W=15.40' n= 0.030 Stream, clean & straight
11.1	7,995	0.0360	12.05	403.56	**Trap/Vee/Rect Channel Flow, Channel Flow 1E** Bot.W=15.00' D=1.80' Z= 2.0 '/' Top.W=22.20' n= 0.030 Stream, clean & straight
67.2	22,576	Total			

Summary for Subcatchment 2S: Pre #2

Runoff = 246.5 cfs @ 12.53 hrs, Volume= 36.283 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
7,078,584	55	Woods, Good, HSG B
4,045,832	70	Woods, Good, HSG C
6,876,935	77	Woods, Good, HSG D
18,001,351	67	Weighted Average
18,001,351		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	100	0.0300	0.08		**Sheet Flow, Sheet Flow 2A** Woods: Light underbrush n= 0.400 P2= 2.65"
6.6	737	0.1380	1.86		**Shallow Concentrated Flow, Shallow Flow 2B** Woodland Kv= 5.0 fps
2.6	1,783	0.2370	11.64	33.52	**Trap/Vee/Rect Channel Flow, Channel Flow 1 2C** Bot.W=2.00' D=0.80' Z= 2.0 '/' Top.W=5.20' n= 0.040 Mountain streams
4.9	3,558	0.1380	12.15	109.59	**Trap/Vee/Rect Channel Flow, Channel Flow 2 2D** Bot.W=6.00' D=1.10' Z= 2.0 '/' Top.W=10.40' n= 0.040 Mountain streams
34.2	6,178	Total			

Summary for Subcatchment 3S: Pre #3

Runoff = 7.6 cfs @ 13.15 hrs, Volume= 3.728 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
3,861,903	30	Woods, Good, HSG A
5,250,568	55	Woods, Good, HSG B
751,073	77	Woods, Good, HSG D
9,863,544	47	Weighted Average
9,863,544		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	100	0.1000	0.13		**Sheet Flow, Sheet Flow 3A** Woods: Light underbrush n= 0.400 P2= 2.65"
31.6	3,204	0.1140	1.69		**Shallow Concentrated Flow, Shallow Conc. 3B** Woodland Kv= 5.0 fps
1.0	608	0.1150	9.93	69.74	**Trap/Vee/Rect Channel Flow, Channel Flow 3C** Bot.W=6.00' D=0.90' Z= 2.0 '/' Top.W=9.60' n= 0.040
45.0	3,912	Total			

Summary for Subcatchment 4S: Pre #4

Runoff = 15.0 cfs @ 12.64 hrs, Volume= 3.815 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
2,723,965	30	Woods, Good, HSG A
583,368	55	Woods, Good, HSG B
2,450,311	70	Woods, Good, HSG C
428,083	77	Woods, Good, HSG D
6,185,727	51	Weighted Average
6,185,727		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	75	0.0500	0.10		**Sheet Flow, Sheet Flow 4A** Woods: Light underbrush n= 0.400 P2= 2.65"
2.2	25	0.4800	0.19		**Sheet Flow, Sheet Flow 4B** Woods: Light underbrush n= 0.400 P2= 2.65"
1.6	270	0.3190	2.82		**Shallow Concentrated Flow, Shallow Conc. 4C** Woodland Kv= 5.0 fps
9.8	4,139	0.1180	7.04	13.52	**Trap/Vee/Rect Channel Flow, Channel Flow 1 4D** Bot.W=2.00' D=0.60' Z= 2.0 '/' Top.W=4.40' n= 0.040
1.1	630	0.1430	9.90	44.33	**Trap/Vee/Rect Channel Flow, Channel Flow 2 4E** Bot.W=4.00' D=0.80' Z= 2.0 '/' Top.W=7.20' n= 0.040
27.7	5,139	Total			

Summary for Subcatchment 5S: Pre #5

Runoff = 39.3 cfs @ 12.53 hrs, Volume= 7.434 af, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
2,312,957	30	Woods, Good, HSG A
2,344,080	55	Woods, Good, HSG B
2,466,386	70	Woods, Good, HSG C
1,120,355	77	Woods, Good, HSG D
8,243,778	55	Weighted Average
8,243,778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	60	0.1000	0.12		**Sheet Flow, Sheet Flow 5A** Woods: Light underbrush n= 0.400 P2= 2.65"
4.8	40	0.1750	0.14		**Sheet Flow, Sheet Flow 5B** Woods: Light underbrush n= 0.400 P2= 2.65"
0.8	107	0.1800	2.12		**Shallow Concentrated Flow, Shallow Conc. 5C** Woodland Kv= 5.0 fps
7.7	3,770	0.1600	8.20	15.75	**Trap/Vee/Rect Channel Flow, Channel Flow 1 5D** Bot.W=2.00' D=0.60' Z= 2.0 '/' Top.W=4.40' n= 0.040
4.5	2,226	0.1060	8.21	30.22	**Trap/Vee/Rect Channel Flow, Channel Flow 2 5E** Bot.W=3.00' D=0.80' Z= 2.0 '/' Top.W=6.20' n= 0.040
26.0	6,203	Total			

Summary for Subcatchment 6S: Pre #6

Runoff = 179.4 cfs @ 12.50 hrs, Volume= 25.044 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
10,637,566	70	Woods, Good, HSG C
10,637,566		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.1200	0.14		**Sheet Flow, Sheet Flow 6A** Woods: Light underbrush n= 0.400 P2= 2.65"
11.3	876	0.0670	1.29		**Shallow Concentrated Flow, Shallow Conc. 6B** Woodland Kv= 5.0 fps
7.6	4,171	0.1750	9.19	19.11	**Trap/Vee/Rect Channel Flow, Channel Flow 1 6C** Bot.W=1.00' D=0.80' Z= 2.0 '/' Top.W=4.20' n= 0.040
2.6	1,828	0.1700	11.72	58.59	**Trap/Vee/Rect Channel Flow, Channel Flow 2 6D** Bot.W=3.00' D=1.00' Z= 2.0 '/' Top.W=7.00' n= 0.040
33.0	6,975	Total			

Summary for Subcatchment 7S: Pre #7

Runoff = 50.5 cfs @ 12.45 hrs, Volume= 6.697 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
2,844,409	70	Woods, Good, HSG C
2,844,409		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	100	0.0400	0.09		**Sheet Flow, Sheet Flow 7A** Woods: Light underbrush n= 0.400 P2= 2.65"
7.6	1,141	0.2530	2.51		**Shallow Concentrated Flow, Conc. Flow 7B** Woodland Kv= 5.0 fps
4.0	2,055	0.1730	8.53	16.37	**Trap/Vee/Rect Channel Flow, Channel Flow 1 7C** Bot.W=2.00' D=0.60' Z= 2.0 '/' Top.W=4.40' n= 0.040
29.5	3,296	Total			

Summary for Subcatchment 8S: Pre #8

Runoff = 200.1 cfs @ 12.48 hrs, Volume= 27.412 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
21,586	96	Gravel Road Surface, 99% imp, HSG C
11,622,107	70	Woods, Good, HSG C
11,643,693	70	Weighted Average
11,622,323		99.82% Pervious Area
21,370		0.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0900	0.13		**Sheet Flow, Sheet Flow 8A** Woods: Light underbrush n= 0.400 P2= 2.65"
7.2	600	0.0780	1.40		**Shallow Concentrated Flow, Conc. Flow 8B** Woodland Kv= 5.0 fps
2.9	1,764	0.1980	10.25	25.43	**Trap/Vee/Rect Channel Flow, Channel Flow 1 8C** Bot.W=1.50' D=0.80' Z= 2.0 '/' Top.W=4.70' n= 0.040 Mountain streams
8.7	5,274	0.1100	10.07	70.50	**Trap/Vee/Rect Channel Flow, Channel Flow 2 8D** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.040 Mountain streams
31.7	7,738	Total			

Summary for Subcatchment 9S: Pre #9

Runoff = 646.6 cfs @ 12.60 hrs, Volume= 99.973 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
1,267,758	30	Woods, Good, HSG A
4,040,608	55	Woods, Good, HSG B
31,843,685	70	Woods, Good, HSG C
7,095,504	77	Woods, Good, HSG D
410,433	98	Water Surface, 0% imp, HSG D
44,657,988	69	Weighted Average
44,657,988		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	100	0.0800	0.12		**Sheet Flow, Sheet Flow 9A** Woods: Light underbrush n= 0.400 P2= 2.65"
13.7	1,535	0.1390	1.86		**Shallow Concentrated Flow, Shallow Flow 9B** Woodland Kv= 5.0 fps
3.4	1,271	0.0900	6.15	11.81	**Trap/Vee/Rect Channel Flow, Channel Flow 1 9C** Bot.W=2.00' D=0.60' Z= 2.0 '/' Top.W=4.40' n= 0.040
3.7	1,377	0.0610	6.23	22.93	**Trap/Vee/Rect Channel Flow, Channel Flow 2 9D** Bot.W=3.00' D=0.80' Z= 2.0 '/' Top.W=6.20' n= 0.040 Mountain streams
5.4	3,655	0.0850	11.26	170.28	**Trap/Vee/Rect Channel Flow, Channel Flow 3 9E** Bot.W=8.00' D=1.40' Z= 2.0 '/' Top.W=13.60' n= 0.040 Mountain streams
39.8	7,938	Total			

Summary for Subcatchment 10S: Pre #10

Runoff = 869.0 cfs @ 12.70 hrs, Volume= 148.645 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
540,408	30	Woods, Good, HSG A
188,646	96	Gravel Road Surface, 99% imp, HSG B
160,193	58	Meadow, non-grazed, HSG B
869,410	68	1 acre lots, 20% imp, HSG B
16,818,573	55	Woods, Good, HSG B
318,247	96	Gravel Road Surface, 99% imp, HSG C
248,239	71	Meadow, non-grazed, HSG C
1,433,541	79	1 acre lots, 20% imp, HSG C
50,286,647	70	Woods, Good, HSG C
2,883,578	77	Woods, Good, HSG D
73,747,482	67	Weighted Average
72,785,068		98.69% Pervious Area
962,414		1.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	100	0.2000	0.18		**Sheet Flow, Sheet Flow 10A** Woods: Light underbrush n= 0.400 P2= 2.65"
4.0	600	0.2500	2.50		**Shallow Concentrated Flow, Shallow Concentration 10B** Woodland Kv= 5.0 fps
10.8	4,291	0.1000	6.61	10.31	**Trap/Vee/Rect Channel Flow, Channel Flow 1 10C** Bot.W=2.00' D=0.60' Z= 1.0 '/' Top.W=3.20' n= 0.040 Earth, dense weeds
8.6	2,450	0.0350	4.75	24.32	**Trap/Vee/Rect Channel Flow, Channel Flow 2 10D** Bot.W=4.00' D=0.80' Z= 3.0 '/' Top.W=8.80' n= 0.040
13.0	9,924	0.0530	12.71	301.02	**Trap/Vee/Rect Channel Flow, Channel Flow 3 10E** Bot.W=10.00' D=1.60' Z= 3.0 '/' Top.W=19.60' n= 0.030 Stream, clean & straight
45.8	17,365	Total			

Summary for Link 1AP: Analysis Point 1

Inflow Area = 2,832.68 ac, 1.44% Impervious, Inflow Depth = 1.11" for 10 yr event
Inflow = 1,234.2 cfs @ 12.98 hrs, Volume= 262.300 af
Primary = 1,234.2 cfs @ 12.98 hrs, Volume= 262.300 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 2AP: Analysis Point 2

Inflow Area = 413.25 ac, 0.00% Impervious, Inflow Depth = 1.05" for 10 yr event
Inflow = 246.5 cfs @ 12.53 hrs, Volume= 36.283 af
Primary = 246.5 cfs @ 12.53 hrs, Volume= 36.283 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 3AP: Analysis Point 3

Inflow Area = 226.44 ac, 0.00% Impervious, Inflow Depth = 0.20" for 10 yr event
Inflow = 7.6 cfs @ 13.15 hrs, Volume= 3.728 af
Primary = 7.6 cfs @ 13.15 hrs, Volume= 3.728 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 4AP: Analysis Point 4

Inflow Area = 142.00 ac, 0.00% Impervious, Inflow Depth = 0.32" for 10 yr event
Inflow = 15.0 cfs @ 12.64 hrs, Volume= 3.815 af
Primary = 15.0 cfs @ 12.64 hrs, Volume= 3.815 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 5AP: Analysis Point 5

Inflow Area = 189.25 ac, 0.00% Impervious, Inflow Depth = 0.47" for 10 yr event
Inflow = 39.3 cfs @ 12.53 hrs, Volume= 7.434 af
Primary = 39.3 cfs @ 12.53 hrs, Volume= 7.434 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 6AP: Analysis Point 6

Inflow Area = 244.20 ac, 0.00% Impervious, Inflow Depth = 1.23" for 10 yr event
Inflow = 179.4 cfs @ 12.50 hrs, Volume= 25.044 af
Primary = 179.4 cfs @ 12.50 hrs, Volume= 25.044 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 7AP: Analysis Point 7

Inflow Area = 65.30 ac, 0.00% Impervious, Inflow Depth = 1.23" for 10 yr event
Inflow = 50.5 cfs @ 12.45 hrs, Volume= 6.697 af
Primary = 50.5 cfs @ 12.45 hrs, Volume= 6.697 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 8AP: Analysis Point 8

Inflow Area = 267.30 ac, 0.18% Impervious, Inflow Depth = 1.23" for 10 yr event
Inflow = 200.1 cfs @ 12.48 hrs, Volume= 27.412 af
Primary = 200.1 cfs @ 12.48 hrs, Volume= 27.412 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 9AP: Analysis Point 9

Inflow Area = 1,025.21 ac, 0.00% Impervious, Inflow Depth = 1.17" for 10 yr event
Inflow = 646.6 cfs @ 12.60 hrs, Volume= 99.973 af
Primary = 646.6 cfs @ 12.60 hrs, Volume= 99.973 af, Atten= 0%, Lag= 0.0 min

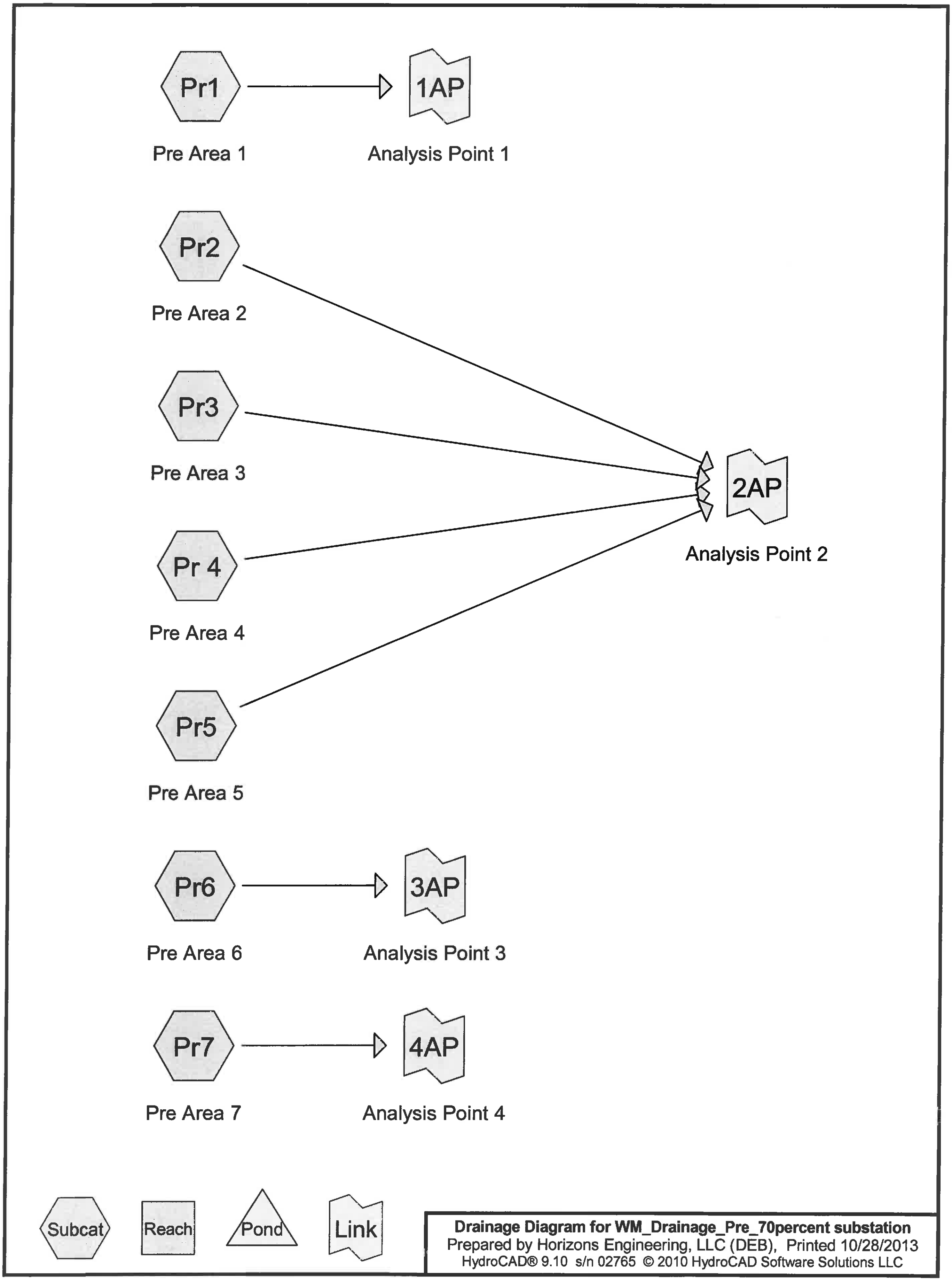
Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 10AP: Analysis Point 10

Inflow Area = 1,693.01 ac, 1.31% Impervious, Inflow Depth = 1.05" for 10 yr event
Inflow = 869.0 cfs @ 12.70 hrs, Volume= 148.645 af
Primary = 869.0 cfs @ 12.70 hrs, Volume= 148.645 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

B. Substation Interconnection Station



Drainage Diagram for WM_Drainage_Pre_70percent substation
Prepared by Horizons Engineering, LLC (DEB), Printed 10/28/2013
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Project Notes

24-hour rainfall from Northeast Regional Climate Center, 71.796 deg W, 43.581 deg N, elev. 637 ft (Substation location, most conservative)

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.43	30	Meadow, non-grazed, HSG A (Pr 4, Pr5, Pr6, Pr7)
0.49	30	Woods, Good, HSG A (Pr 4, Pr3, Pr6)
0.91	55	Woods, Good, HSG B (Pr 4, Pr1, Pr2, Pr3, Pr5)
0.96	58	Meadow, non-grazed, HSG B (Pr 4, Pr1, Pr2, Pr3, Pr5, Pr6)
42.48	70	Woods, Good, HSG C (Pr 4, Pr1, Pr2, Pr3, Pr6, Pr7)
3.81	71	Meadow, non-grazed, HSG C (Pr 4, Pr2, Pr6, Pr7)
5.03	77	Woods, Good, HSG D (Pr 4, Pr1, Pr2, Pr3, Pr5, Pr6)
1.02	78	Meadow, non-grazed, HSG D (Pr 4, Pr2, Pr3, Pr5, Pr6)
0.14	96	Gravel (Pr2)
0.12	98	Gravel (Pr3, Pr5)
0.25	98	x Paved roads (Pr2)
0.02	98	x Roofs (Pr2)
56.66	69	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.92	HSG A	Pr 4, Pr3, Pr5, Pr6, Pr7
1.87	HSG B	Pr 4, Pr1, Pr2, Pr3, Pr5, Pr6
46.29	HSG C	Pr 4, Pr1, Pr2, Pr3, Pr6, Pr7
6.05	HSG D	Pr 4, Pr1, Pr2, Pr3, Pr5, Pr6
0.53	Other	Pr2, Pr3, Pr5
56.66		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	Pr2	0.00	0.00	40.0	0.0300	0.025	24.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Pr 4: Pre Area 4 Runoff Area=2.34 ac 0.00% Impervious Runoff Depth=1.00"
Flow Length=533' Tc=28.0 min CN=66 Runoff=1.43 cfs 0.194 af

Subcatchment Pr1: Pre Area 1 Runoff Area=10.96 ac 0.00% Impervious Runoff Depth=1.23"
Flow Length=945' Tc=21.5 min CN=70 Runoff=9.70 cfs 1.124 af

Subcatchment Pr2: Pre Area 2 Runoff Area=33.26 ac 0.81% Impervious Runoff Depth=1.29"
Flow Length=3,835' Tc=28.0 min CN=71 Runoff=27.95 cfs 3.582 af

Subcatchment Pr3: Pre Area 3 Runoff Area=1.81 ac 2.76% Impervious Runoff Depth=1.00"
Flow Length=395' Tc=11.6 min CN=66 Runoff=1.56 cfs 0.150 af

Subcatchment Pr5: Pre Area 5 Runoff Area=0.81 ac 8.64% Impervious Runoff Depth=1.11"
Flow Length=225' Slope=0.0200 '/' Tc=26.5 min CN=68 Runoff=0.58 cfs 0.075 af

Subcatchment Pr6: Pre Area 6 Runoff Area=5.11 ac 0.00% Impervious Runoff Depth=0.84"
Flow Length=1,120' Tc=20.3 min CN=63 Runoff=2.81 cfs 0.357 af

Subcatchment Pr7: Pre Area 7 Runoff Area=2.37 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=511' Tc=11.1 min CN=65 Runoff=1.92 cfs 0.186 af

Link 1AP: Analysis Point 1 Inflow=9.70 cfs 1.124 af
Primary=9.70 cfs 1.124 af

Link 2AP: Analysis Point 2 Inflow=30.92 cfs 4.002 af
Primary=30.92 cfs 4.002 af

Link 3AP: Analysis Point 3 Inflow=2.81 cfs 0.357 af
Primary=2.81 cfs 0.357 af

Link 4AP: Analysis Point 4 Inflow=1.92 cfs 0.186 af
Primary=1.92 cfs 0.186 af

Total Runoff Area = 56.66 ac Runoff Volume = 5.669 af Average Runoff Depth = 1.20"
99.31% Pervious = 56.27 ac 0.69% Impervious = 0.39 ac

Summary for Subcatchment Pr 4: Pre Area 4

Runoff = 1.43 cfs @ 12.44 hrs, Volume= 0.194 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (ac)	CN	Description
0.38	30	Woods, Good, HSG A
0.01	55	Woods, Good, HSG B
0.37	70	Woods, Good, HSG C
1.02	77	Woods, Good, HSG D
0.08	30	Meadow, non-grazed, HSG A
0.03	58	Meadow, non-grazed, HSG B
0.10	71	Meadow, non-grazed, HSG C
0.35	78	Meadow, non-grazed, HSG D
2.34	66	Weighted Average
2.34		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	100	0.0200	0.07		**Sheet Flow, Pre 4** Woods: Light underbrush n= 0.400 P2= 2.65"
4.4	433	0.1060	1.63		**Shallow Concentrated Flow, Pre 4** Woodland Kv= 5.0 fps
28.0	533	Total			

Summary for Subcatchment Pr1: Pre Area 1

Runoff = 9.70 cfs @ 12.32 hrs, Volume= 1.124 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (ac)	CN	Description
0.24	55	Woods, Good, HSG B
9.57	70	Woods, Good, HSG C
0.96	77	Woods, Good, HSG D
0.19	58	Meadow, non-grazed, HSG B
10.96	70	Weighted Average
10.96		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0900	0.13		**Sheet Flow, Pre 1** Woods: Light underbrush n= 0.400 P2= 2.65"
7.2	420	0.1500	0.97		**Shallow Concentrated Flow, Pre 1** Forest w/Heavy Litter Kv= 2.5 fps
1.4	425	0.0350	5.04	20.17	**Trap/Vee/Rect Channel Flow, Pre 1** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040 Mountain streams
21.5	945	Total			

Summary for Subcatchment Pr2: Pre Area 2

Runoff = 27.95 cfs @ 12.42 hrs, Volume= 3.582 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.14	55	Woods, Good, HSG B
	29.37	70	Woods, Good, HSG C
	2.03	77	Woods, Good, HSG D
	0.11	58	Meadow, non-grazed, HSG B
	0.93	71	Meadow, non-grazed, HSG C
	0.27	78	Meadow, non-grazed, HSG D
*	0.25	98	x Paved roads
*	0.02	98	x Roofs
*	0.14	96	Gravel
	33.26	71	Weighted Average
	32.99		99.19% Pervious Area
	0.27		0.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.2200	0.18		**Sheet Flow, Pre 2** Woods: Light underbrush n= 0.400 P2= 2.65"
15.7	2,185	0.2150	2.32		**Shallow Concentrated Flow, Pre 2** Woodland Kv= 5.0 fps
0.1	40	0.0300	6.49	20.38	**Pipe Channel, Pre 2** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.025 Corrugated metal
3.2	1,510	0.0832	7.77	31.10	**Trap/Vee/Rect Channel Flow, Pre 2** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040
28.0	3,835	Total			

Summary for Subcatchment Pr3: Pre Area 3

Runoff = 1.56 cfs @ 12.18 hrs, Volume= 0.150 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.10	30	Woods, Good, HSG A
	0.51	55	Woods, Good, HSG B
	0.11	70	Woods, Good, HSG C
	0.70	77	Woods, Good, HSG D
	0.22	58	Meadow, non-grazed, HSG B
	0.12	78	Meadow, non-grazed, HSG D
*	0.05	98	Gravel
	1.81	66	Weighted Average
	1.76		97.24% Pervious Area
	0.05		2.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.2400	0.19		**Sheet Flow, Pre 3** Woods: Light underbrush n= 0.400 P2= 2.65"
2.9	295	0.1150	1.70		**Shallow Concentrated Flow, Pre 3** Woodland Kv= 5.0 fps
11.6	395	Total			

Summary for Subcatchment Pr5: Pre Area 5

Runoff = 0.58 cfs @ 12.40 hrs, Volume= 0.075 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.01	55	Woods, Good, HSG B
	0.23	77	Woods, Good, HSG D
	0.10	30	Meadow, non-grazed, HSG A
	0.20	58	Meadow, non-grazed, HSG B
	0.20	78	Meadow, non-grazed, HSG D
*	0.07	98	Gravel
	0.81	68	Weighted Average
	0.74		91.36% Pervious Area
	0.07		8.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	100	0.0200	0.07		**Sheet Flow, Pre 5** Woods: Light underbrush n= 0.400 P2= 2.65"
2.9	125	0.0200	0.71		**Shallow Concentrated Flow, Pre 5** Woodland Kv= 5.0 fps
26.5	225	Total			

Summary for Subcatchment Pr6: Pre Area 6

Runoff = 2.81 cfs @ 12.34 hrs, Volume= 0.357 af, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (ac)	CN	Description
0.01	30	Woods, Good, HSG A
3.05	70	Woods, Good, HSG C
0.09	77	Woods, Good, HSG D
0.92	30	Meadow, non-grazed, HSG A
0.21	58	Meadow, non-grazed, HSG B
0.75	71	Meadow, non-grazed, HSG C
0.08	78	Meadow, non-grazed, HSG D
5.11	63	Weighted Average
5.11		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.1200	0.14		**Sheet Flow, Pre 6** Woods: Light underbrush n= 0.400 P2= 2.65"
7.7	780	0.1150	1.70		**Shallow Concentrated Flow, Pre 6** Woodland Kv= 5.0 fps
1.1	240	0.0167	3.48	13.93	**Trap/Vee/Rect Channel Flow, Pre 6** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040
20.3	1,120	Total			

Summary for Subcatchment Pr7: Pre Area 7

Runoff = 1.92 cfs @ 12.17 hrs, Volume= 0.186 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (ac)	CN	Description
0.01	70	Woods, Good, HSG C
0.33	30	Meadow, non-grazed, HSG A
2.03	71	Meadow, non-grazed, HSG C
2.37	65	Weighted Average
2.37		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.2100	0.18		**Sheet Flow, Pre 7** Woods: Light underbrush n= 0.400 P2= 2.65"
1.0	186	0.4100	3.20		**Shallow Concentrated Flow, Pre 7** Woodland Kv= 5.0 fps
0.9	225	0.0267	4.40	17.62	**Trap/Vee/Rect Channel Flow, Pre 7** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040
11.1	511	Total			

Summary for Link 1AP: Analysis Point 1

Inflow Area = 10.96 ac, 0.00% Impervious, Inflow Depth = 1.23" for 10 yr event
Inflow = 9.70 cfs @ 12.32 hrs, Volume= 1.124 af
Primary = 9.70 cfs @ 12.32 hrs, Volume= 1.124 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 2AP: Analysis Point 2

Inflow Area = 38.22 ac, 1.02% Impervious, Inflow Depth = 1.26" for 10 yr event
Inflow = 30.92 cfs @ 12.41 hrs, Volume= 4.002 af
Primary = 30.92 cfs @ 12.41 hrs, Volume= 4.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link 3AP: Analysis Point 3

Inflow Area = 5.11 ac, 0.00% Impervious, Inflow Depth = 0.84" for 10 yr event
Inflow = 2.81 cfs @ 12.34 hrs, Volume= 0.357 af
Primary = 2.81 cfs @ 12.34 hrs, Volume= 0.357 af, Atten= 0%, Lag= 0.0 min

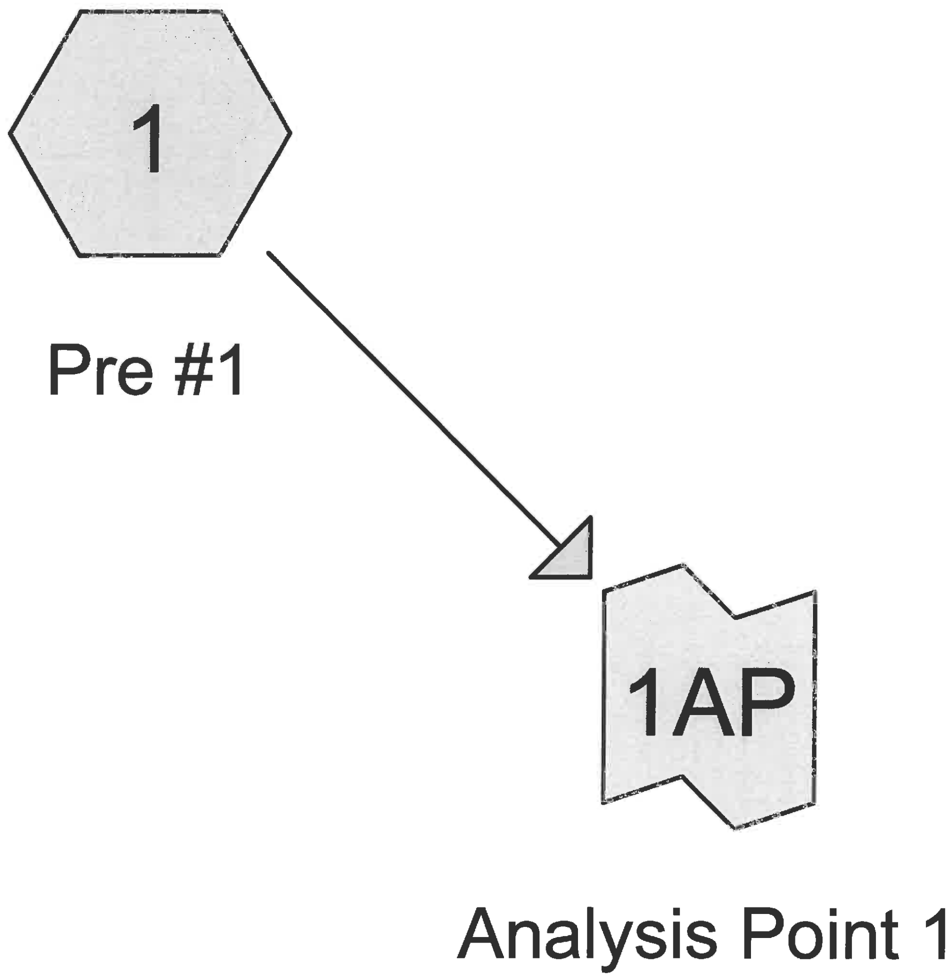
Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

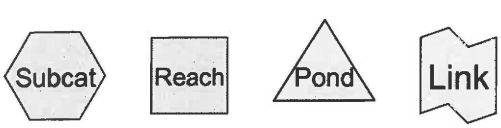
Summary for Link 4AP: Analysis Point 4

Inflow Area = 2.37 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10 yr event
Inflow = 1.92 cfs @ 12.17 hrs, Volume= 0.186 af
Primary = 1.92 cfs @ 12.17 hrs, Volume= 0.186 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

C. Operation and Maintenance Building





Routing Diagram for O-M_Drainage_Pre_70percent
Prepared by Microsoft, Printed 10/28/2013
HydroCAD® 10.00 s/n 02765 © 2013 HydroCAD Software Solutions LLC

Project Notes

24-hour rainfall from Northeast Regional Climate Center, 71.796 deg W, 43.581 deg N, elev. 637 ft (Substation location, most conservative)

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.79	96	Gravel (1)
8.54	71	Meadow, non-grazed, HSG C (1)
2.01	78	Meadow, non-grazed, HSG D (1)
4.00	70	Woods, Good, HSG C (1)
0.20	77	Woods, Good, HSG D (1)
15.54	**73**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.00	HSG A	
0.00	HSG B	
12.54	HSG C	1
2.21	HSG D	1
0.79	Other	1
15.54		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.00	0.00	0.00	0.00	0.79	0.79	Gravel	1
0.00	0.00	8.54	2.01	0.00	10.55	Meadow, non-grazed	1
0.00	0.00	4.00	0.20	0.00	4.20	Woods, Good	1
0.00	**0.00**	**12.54**	**2.21**	**0.79**	**15.54**	**TOTAL AREA**	

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Pre #1 Runoff Area=15.54 ac 0.00% Impervious Runoff Depth=1.42"
Flow Length=1,400' Tc=35.2 min CN=73 Runoff=13.1 cfs 1.840 af

Link 1AP: Analysis Point 1 Inflow=13.1 cfs 1.840 af
Primary=13.1 cfs 1.840 af

Total Runoff Area = 15.54 ac Runoff Volume = 1.840 af Average Runoff Depth = 1.42"
100.00% Pervious = 15.54 ac 0.00% Impervious = 0.00 ac

Summary for Subcatchment 1: Pre #1

Runoff = 13.1 cfs @ 12.52 hrs, Volume= 1.840 af, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
*	0.09	96	Gravel
	0.70	96	Gravel
	7.48	71	Meadow, non-grazed, HSG C
	0.92	71	Meadow, non-grazed, HSG C
	0.14	71	Meadow, non-grazed, HSG C
	4.00	70	Woods, Good, HSG C
	2.01	78	Meadow, non-grazed, HSG D
	0.18	77	Woods, Good, HSG D
	0.02	77	Woods, Good, HSG D
	15.54	73	Weighted Average
	15.54		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	100	0.0600	0.16		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 2.65"
7.5	590	0.0350	1.31		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
6.2	370	0.0400	1.00		**Shallow Concentrated Flow, Shallow Conc.** Woodland Kv= 5.0 fps
11.4	340	0.0050	0.49		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
35.2	1,400	Total			

Summary for Link 1AP: Analysis Point 1

Inflow Area = 15.54 ac, 0.00% Impervious, Inflow Depth = 1.42" for 10 yr event
Inflow = 13.1 cfs @ 12.52 hrs, Volume= 1.840 af
Primary = 13.1 cfs @ 12.52 hrs, Volume= 1.840 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

3.4 Post-Development Analysis

3.4A Post-Development Analysis

3.4A Post-Development Analysis

Pre-development areas Pre#1 thru Pre#10 were broken out into eleven post-development areas identified as Post#1 through Post#11. Post development watersheds associated with the substation and operation and maintenance facility are considered separately and each have their own post development analysis areas In general, the post-development areas have not changed, some areas are slightly larger while others are slightly smaller, and the total post-watershed area is equal to the pre-watershed area of 7,099 acres. The small increase or decrease in watershed areas is a result of the development of the new roads and turbine pad areas.

Drainage area Post#1 is smaller than Pre#1 by 2.3 acres and the Tc has not changed.

Drainage area Post#2 is larger than Pre#2 by 1.3 acres and the Tc has not changed.

Drainage area Post #3 is smaller than Pre#3 by 0.5 acres and the Tc has not changed.

Drainage area Post#4 is smaller than Pre#4 by 1.6 acres and the Tc has not changed.

Drainage area Pre#5 was broken out into two post watershed areas, Post#5 and Post #5A. The combination of Post #5 and Post #5A are similar to Pre#5. Post#5A includes the storm water flowing to the proposed detention basin located along the East Crane road to turbine E1 to reduce the increase in flows as a result of the associated roadways and turbine pad. This storm water detention basin allows post development flow rates to remain the same or less than pre-development flow rates to Analysis Point #5.

Drainage area Post#6 is larger than Pre#6 by 2.2 acres and the Tc has not changed.

Drainage area Post#7 is smaller than Pre#7 by 0.2 acres and the Tc has not changed.

Drainage area Post#8 is smaller that Pre#8 by 1.0 acres and the Tc has decreased slightly.

Drainage area Post#9 is larger than Pre#9 by 2.2 acres and the Tc is generally the same.

Drainage area Post#10 has not changed nor has the Tc as compared to Pre#10.

For more detailed information on post-developed areas, see attached drainage plans found in **Section 4** and the HydroCAD area listings found in **Section 3.4.1A**. A pre- versus post-development comparison flow rate table for the 2, 10, and 50 year storm events can be found in **Table 2.0A** in **Section 2.6.1A**.

3.4B Post-Development Analysis (Substation)

3.4B Post-Development Analysis (Substation)

As in the pre-development analysis, the total watershed area is 56.66 acres. Pre-development area boundaries remained virtually unchanged in the post-development analysis, and are similarly identified as post-development areas Po-1 thru Po-7, with the addition of Po-8 and Po-9. Areas Po-8 and Po-9 include the new impervious areas for the access road, substation and the interconnection station. The new impervious areas have been removed from drainages areas Po-1 thru Po-7.

The drainage model for this project uses a micro extended detention pond at Po-9, a surface filtration pond at Po-8 and a treatment swale at Po-5. These stormwater structures will provide treatment and ground water re-charge from the newly developed areas for the access road, substation and interconnection station.

Boundaries of drainage area Po-1 are almost identical to those of Pr-1. No new impervious area is included in this drainage area and only a small portion of this area was removed as a result of grading for the new substation, therefore, there are no increases in stormwater runoff at discharge point AP1.

Drainage area Po-2 is the same basic area as Pr-2 with the southeast boundary modified by the addition of the new substation and interconnection station, as well as the new access road cutting off the channel to the existing wetland (AP2). A new culvert, CV1, will be installed under the new access road along the existing intermittent stream to allow continued flow to the wetland area at (AP2).

Drainage area Po-3 is the remaining area to the south of the new access road, substation and interconnection station. Stormwater runoff will continue to flow into area AP2. Proposed impervious areas do not flow thru this area as all roads will be graded to ensure runoff from impervious surfaces are directed to one of the stormwater treatment structures.

Drainage area Po-4 is similar to the pre-development area Pr-4, which includes mostly undeveloped land to the north of the new access road and to the east of the interconnection station. A small portion on the proposed road (75’ by 16’) is directed to this area and will discharge to AP2 thru culvert CV2.

Post-development area Po-5, again, is similar to pre-development area Pr-5 and includes the proposed access road from station 0+00 to station 2+75, and the undeveloped land near the existing utility easement. Stormwater runoff from the proposed road is directed to the ditch on the north side of the access road. Runoff from the ditch is then directed to proposed treatment swale TS1 proposed road station 1+75. After stormwater is treated at TS1, flows are directed to the wetlands at AP2.

Post-drainage areas Po-6 and Po-7 do not change as a result of the proposed work, and the results from the pre- and post- models confirms no increase in runoff from these areas. It should also be noted that the property does continue in a northerly direction away from the proposed development, and the analysis does not include this area as no new development is proposed in this northerly section of the site. As the model indicates for areas with no change from pre- to post-development, such as 6 and 7, no increase in offsite runoff, the same will hold true for the northerly section of the property.

Post-drainage area Po-8 includes the proposed substation, and the proposed access road from station 7+00 to station 9+95. This area consists of mostly proposed gravel or impervious area. The access road runoff will be directed to a ditch along the northern edge of the road. This ditch will direct runoff towards the substation and into a culvert at station 9+25. The runoff from this culvert, as well as, from the substation area will be pre-treated at the fore bay located on the west side of the road just south of the substation. Runoff will then be directed to a surface filtration pond identified as INF1. The filtration pond will infiltrate 2,900 cf of runoff in approximately 5 hours, which is well above the required ground water recharge volume of 711 cf. Any additional runoff not infiltrated will be directed to analysis point AP2.

Post-drainage area Po-9 includes the proposed access road from station 3+25 to 7+00, and the interconnections station. Stormwater runoff will flow to the proposed fore bay and then into micro extended detention pond (MP1) located near station 6+00. Stormwater will be detained and released to the bog wetland area at AP2.

In summary, the analysis indicates that AP1, AP3, and AP4 do not include any proposed impervious areas and do not show an increase in runoff as a result of the proposed development. Analysis point AP2 indicates a small reduction in flows as a result of the inclusion of the micro pool extend detention pond and the filtration pond to detain and infiltrate the stormwater runoff.

For more detailed information on post-developed areas, see attached drainage plans found in **Section 4** and the HydroCAD area listings found in **Section 3.4.1**. A pre- versus post-development comparison flow rate table for the 2, 10, and 50 year storm events can be found in **Table 2.0B** in **Section 2.6.1B**.

3.4C Post-Development Analysis (O&M Building)

3.4C Post-Development Analysis (O&M Building)

Pre-development area boundaries changed slightly in the post-development analysis due to roadway configuration and grading. The intent of this drainage design was to capture as much run-off associated with the project and direct it to a stormwater pond at the low point of the site. Areas Post 1.1 and Post 1.2 include the new impervious areas for the access roads, operations and maintenance building, snow cat storage building, and associated gravel parking. Area Post 1.3 captures the remaining runoff associated with the access road, prior to entering the stormwater pond. Area Post 1.4 captures the remaining runoff to the west of the proposed access road, containing primarily the remaining undisturbed watershed that discharges to Grants Pond.

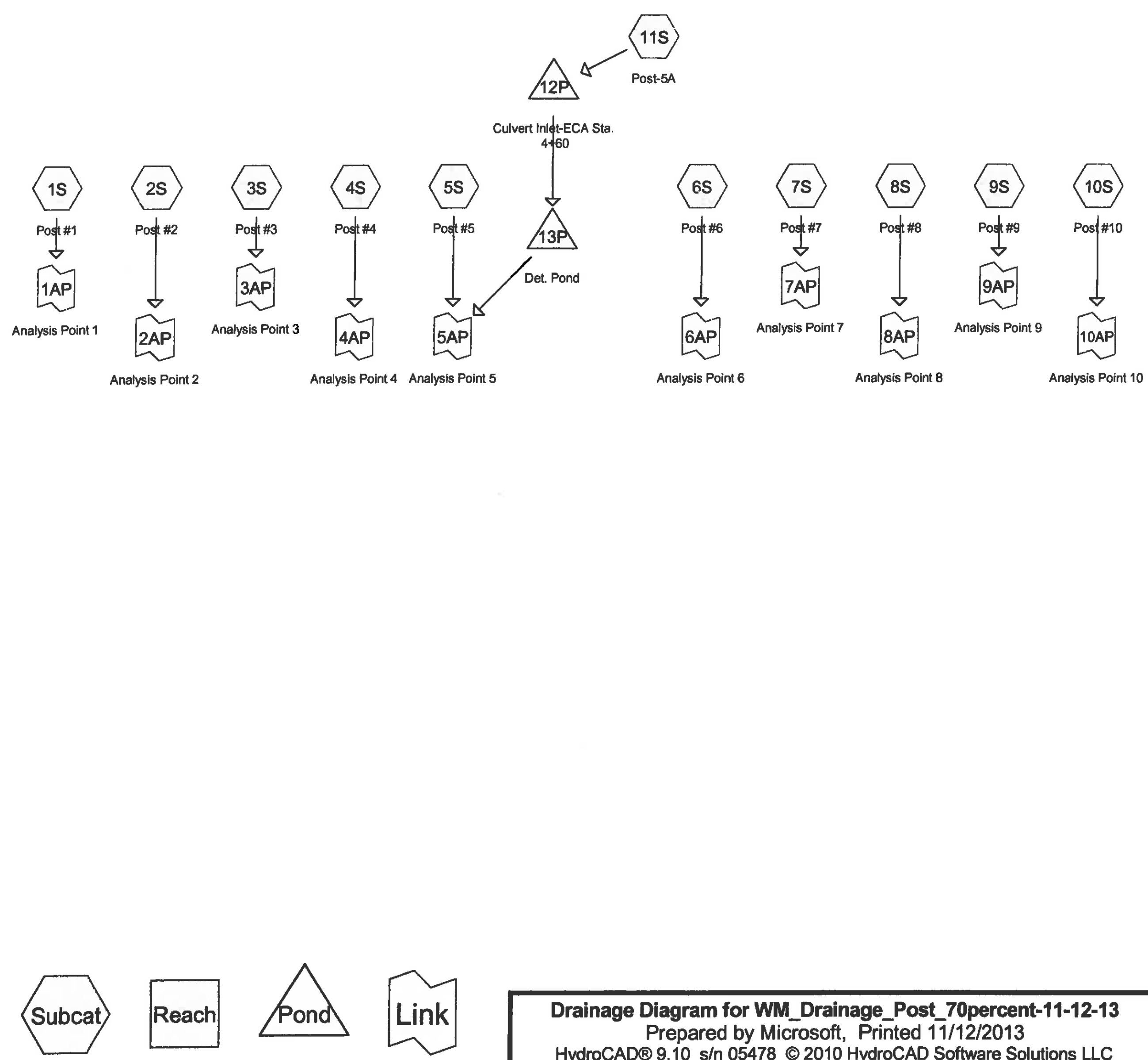
The drainage model for this project uses a surface filtration pond that provides treatment and groundwater re-charge from the newly developed areas for the access roads and operations and maintenance facility. The proposed treatment devices have been sized to meet the State regulations to reduce the impact to abutting properties and maintain water quality within the overall watersheds. Roadway culverts and storm drains have been designed to pass a 50-year rainfall without overtopping the roadways. The stormwater filtration pond has been analyzed for the 50-year storm event and is designed to maintain 1 foot of freeboard between the top of the pond embankment and the 50-year peak water elevation. Stone outlet protections for pond outlet structures and roadway culverts are sized using the peak flow for the 50-year rainfall event.

For more detailed information on post-developed areas, see attached drainage plans found in **Section 4** and the HydroCAD area listings found in **Section 3.4.1**. A pre- versus post-development comparison flow rate table for the 2, 10, and 50 year storm events can be found in **Table 2.0C** in **Section 2.6.1C**.

3.4.1 Post-Development 2, 10, and 50 - Year Storm

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building

A. Overall Project



Drainage Diagram for WM_Drainage_Post_70percent-11-12-13
Prepared by Microsoft, Printed 11/12/2013
HydroCAD® 9.10 s/n 05478 © 2010 HydroCAD Software Solutions LLC

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post #1 Runoff Area=123,292,544 sf 1.44% Impervious Runoff Depth=0.46"
Flow Length=22,576' Tc=67.2 min CN=68 Runoff=421.0 cfs 107.371 af

Subcatchment 2S: Post #2 Runoff Area=18,056,327 sf 0.00% Impervious Runoff Depth=0.42"
Flow Length=6,178' Tc=34.2 min CN=67 Runoff=80.0 cfs 14.529 af

Subcatchment 3S: Post #3 Runoff Area=9,839,787 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=3,912' Tc=45.0 min CN=47 Runoff=0.4 cfs 0.251 af

Subcatchment 4S: Post #4 Runoff Area=6,114,017 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=5,139' Tc=27.7 min CN=51 Runoff=0.9 cfs 0.600 af

Subcatchment 5S: Post #5 Runoff Area=7,986,845 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=6,203' Tc=26.0 min CN=55 Runoff=3.2 cfs 1.707 af

Subcatchment 6S: Post #6 Runoff Area=10,731,231 sf 0.00% Impervious Runoff Depth=0.53"
Flow Length=7,006' Tc=33.0 min CN=70 Runoff=67.5 cfs 10.856 af

Subcatchment 7S: Post #7 Runoff Area=2,837,525 sf 0.00% Impervious Runoff Depth=0.53"
Flow Length=3,296' Tc=29.5 min CN=70 Runoff=18.8 cfs 2.871 af

Subcatchment 8S: Post #8 Runoff Area=11,598,705 sf 1.39% Impervious Runoff Depth=0.53"
Flow Length=7,709' Tc=31.5 min CN=70 Runoff=74.6 cfs 11.734 af

Subcatchment 9S: Post #9 Runoff Area=44,750,937 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=7,938' Tc=40.0 min CN=69 Runoff=230.9 cfs 42.058 af

Subcatchment 10S: Post #10 Runoff Area=73,747,482 sf 1.39% Impervious Runoff Depth=0.42"
Flow Length=17,365' Tc=45.8 min CN=67 Runoff=281.4 cfs 59.342 af

Subcatchment 11S: Post-5A Runoff Area=261,615 sf 0.00% Impervious Runoff Depth=0.61"
Flow Length=916' Tc=42.9 min CN=72 Runoff=1.8 cfs 0.305 af

Pond 12P: Culvert Inlet-ECA Sta. 4+60 Peak Elev=1,990.74' Storage=28 cf Inflow=1.8 cfs 0.305 af
15.0" Round Culvert n=0.015 L=105.0' S=0.1714 '/' Outflow=1.8 cfs 0.305 af

Pond 13P: Det. Pond Peak Elev=1,976.14' Storage=11,907 cf Inflow=1.8 cfs 0.305 af
Outflow=0.0 cfs 0.070 af

Link 1AP: Analysis Point 1 Inflow=421.0 cfs 107.371 af
Primary=421.0 cfs 107.371 af

Link 2AP: Analysis Point 2 Inflow=80.0 cfs 14.529 af
Primary=80.0 cfs 14.529 af

Link 3AP: Analysis Point 3 Inflow=0.4 cfs 0.251 af
Primary=0.4 cfs 0.251 af

Link 4AP: Analysis Point 4	Inflow=0.9 cfs 0.600 af Primary=0.9 cfs 0.600 af
Link 5AP: Analysis Point 5	Inflow=3.2 cfs 1.777 af Primary=3.2 cfs 1.777 af
Link 6AP: Analysis Point 6	Inflow=67.5 cfs 10.856 af Primary=67.5 cfs 10.856 af
Link 7AP: Analysis Point 7	Inflow=18.8 cfs 2.871 af Primary=18.8 cfs 2.871 af
Link 8AP: Analysis Point 8	Inflow=74.6 cfs 11.734 af Primary=74.6 cfs 11.734 af
Link 9AP: Analysis Point 9	Inflow=230.9 cfs 42.058 af Primary=230.9 cfs 42.058 af
Link 10AP: Analysis Point 10	Inflow=281.4 cfs 59.342 af Primary=281.4 cfs 59.342 af

Total Runoff Area = 7,098.65 ac Runoff Volume = 251.624 af Average Runoff Depth = 0.43"
99.04% Pervious = 7,030.77 ac 0.96% Impervious = 67.88 ac

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post #1 Runoff Area=123,292,544 sf 1.44% Impervious Runoff Depth=1.11"
Flow Length=22,576' Tc=67.2 min CN=68 Runoff=1,233.2 cfs 262.089 af

Subcatchment 2S: Post #2 Runoff Area=18,056,327 sf 0.00% Impervious Runoff Depth=1.05"
Flow Length=6,178' Tc=34.2 min CN=67 Runoff=247.3 cfs 36.394 af

Subcatchment 3S: Post #3 Runoff Area=9,839,787 sf 0.00% Impervious Runoff Depth=0.20"
Flow Length=3,912' Tc=45.0 min CN=47 Runoff=7.6 cfs 3.719 af

Subcatchment 4S: Post #4 Runoff Area=6,114,017 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=5,139' Tc=27.7 min CN=51 Runoff=14.8 cfs 3.771 af

Subcatchment 5S: Post #5 Runoff Area=7,986,845 sf 0.00% Impervious Runoff Depth=0.47"
Flow Length=6,203' Tc=26.0 min CN=55 Runoff=38.1 cfs 7.202 af

Subcatchment 6S: Post #6 Runoff Area=10,731,231 sf 0.00% Impervious Runoff Depth=1.23"
Flow Length=7,006' Tc=33.0 min CN=70 Runoff=181.0 cfs 25.264 af

Subcatchment 7S: Post #7 Runoff Area=2,837,525 sf 0.00% Impervious Runoff Depth=1.23"
Flow Length=3,296' Tc=29.5 min CN=70 Runoff=50.4 cfs 6.680 af

Subcatchment 8S: Post #8 Runoff Area=11,598,705 sf 1.39% Impervious Runoff Depth=1.23"
Flow Length=7,709' Tc=31.5 min CN=70 Runoff=199.9 cfs 27.307 af

Subcatchment 9S: Post #9 Runoff Area=44,750,937 sf 0.00% Impervious Runoff Depth=1.17"
Flow Length=7,938' Tc=40.0 min CN=69 Runoff=646.6 cfs 100.181 af

Subcatchment 10S: Post #10 Runoff Area=73,747,482 sf 1.39% Impervious Runoff Depth=1.05"
Flow Length=17,365' Tc=45.8 min CN=67 Runoff=869.0 cfs 148.645 af

Subcatchment 11S: Post-5A Runoff Area=261,615 sf 0.00% Impervious Runoff Depth=1.36"
Flow Length=916' Tc=42.9 min CN=72 Runoff=4.3 cfs 0.679 af

Pond 12P: Culvert Inlet-ECA Sta. 4+60 Peak Elev=1,991.49' Storage=83 cf Inflow=4.3 cfs 0.679 af
15.0" Round Culvert n=0.015 L=105.0' S=0.1714 '/' Outflow=4.3 cfs 0.679 af

Pond 13P: Det. Pond Peak Elev=1,977.66' Storage=18,486 cf Inflow=4.3 cfs 0.679 af
Outflow=0.5 cfs 0.354 af

Link 1AP: Analysis Point 1 Inflow=1,233.2 cfs 262.089 af
Primary=1,233.2 cfs 262.089 af

Link 2AP: Analysis Point 2 Inflow=247.3 cfs 36.394 af
Primary=247.3 cfs 36.394 af

Link 3AP: Analysis Point 3 Inflow=7.6 cfs 3.719 af
Primary=7.6 cfs 3.719 af

Link 4AP: Analysis Point 4	Inflow=14.8 cfs 3.771 af Primary=14.8 cfs 3.771 af
Link 5AP: Analysis Point 5	Inflow=38.1 cfs 7.556 af Primary=38.1 cfs 7.556 af
Link 6AP: Analysis Point 6	Inflow=181.0 cfs 25.264 af Primary=181.0 cfs 25.264 af
Link 7AP: Analysis Point 7	Inflow=50.4 cfs 6.680 af Primary=50.4 cfs 6.680 af
Link 8AP: Analysis Point 8	Inflow=199.9 cfs 27.307 af Primary=199.9 cfs 27.307 af
Link 9AP: Analysis Point 9	Inflow=646.6 cfs 100.181 af Primary=646.6 cfs 100.181 af
Link 10AP: Analysis Point 10	Inflow=869.0 cfs 148.645 af Primary=869.0 cfs 148.645 af

Total Runoff Area = 7,098.65 ac Runoff Volume = 621.931 af Average Runoff Depth = 1.05"
99.04% Pervious = 7,030.77 ac 0.96% Impervious = 67.88 ac

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post #1 Runoff Area=123,292,544 sf 1.44% Impervious Runoff Depth=2.31"
Flow Length=22,576' Tc=67.2 min CN=68 Runoff=2,749.2 cfs 544.909 af

Subcatchment 2S: Post #2 Runoff Area=18,056,327 sf 0.00% Impervious Runoff Depth=2.23"
Flow Length=6,178' Tc=34.2 min CN=67 Runoff=561.0 cfs 76.860 af

Subcatchment 3S: Post #3 Runoff Area=9,839,787 sf 0.00% Impervious Runoff Depth=0.76"
Flow Length=3,912' Tc=45.0 min CN=47 Runoff=63.2 cfs 14.326 af

Subcatchment 4S: Post #4 Runoff Area=6,114,017 sf 0.00% Impervious Runoff Depth=1.01"
Flow Length=5,139' Tc=27.7 min CN=51 Runoff=76.2 cfs 11.856 af

Subcatchment 5S: Post #5 Runoff Area=7,986,845 sf 0.00% Impervious Runoff Depth=1.29"
Flow Length=6,203' Tc=26.0 min CN=55 Runoff=143.3 cfs 19.681 af

Subcatchment 6S: Post #6 Runoff Area=10,731,231 sf 0.00% Impervious Runoff Depth=2.48"
Flow Length=7,006' Tc=33.0 min CN=70 Runoff=382.9 cfs 50.991 af

Subcatchment 7S: Post #7 Runoff Area=2,837,525 sf 0.00% Impervious Runoff Depth=2.48"
Flow Length=3,296' Tc=29.5 min CN=70 Runoff=106.6 cfs 13.483 af

Subcatchment 8S: Post #8 Runoff Area=11,598,705 sf 1.39% Impervious Runoff Depth=2.48"
Flow Length=7,709' Tc=31.5 min CN=70 Runoff=423.1 cfs 55.112 af

Subcatchment 9S: Post #9 Runoff Area=44,750,937 sf 0.00% Impervious Runoff Depth=2.40"
Flow Length=7,938' Tc=40.0 min CN=69 Runoff=1,398.2 cfs 205.166 af

Subcatchment 10S: Post #10 Runoff Area=73,747,482 sf 1.39% Impervious Runoff Depth=2.23"
Flow Length=17,365' Tc=45.8 min CN=67 Runoff=1,973.8 cfs 313.918 af

Subcatchment 11S: Post-5A Runoff Area=261,615 sf 0.00% Impervious Runoff Depth=2.66"
Flow Length=916' Tc=42.9 min CN=72 Runoff=8.8 cfs 1.332 af

Pond 12P: Culvert Inlet-ECA Sta. 4+60 Peak Elev=1,994.01' Storage=768 cf Inflow=8.8 cfs 1.332 af
15.0" Round Culvert n=0.015 L=105.0' S=0.1714 '/' Outflow=8.6 cfs 1.332 af

Pond 13P: Det. Pond Peak Elev=1,980.00' Storage=31,825 cf Inflow=8.6 cfs 1.332 af
Outflow=1.3 cfs 1.004 af

Link 1AP: Analysis Point 1 Inflow=2,749.2 cfs 544.909 af
Primary=2,749.2 cfs 544.909 af

Link 2AP: Analysis Point 2 Inflow=561.0 cfs 76.860 af
Primary=561.0 cfs 76.860 af

Link 3AP: Analysis Point 3 Inflow=63.2 cfs 14.326 af
Primary=63.2 cfs 14.326 af

Link 4AP: Analysis Point 4
Inflow=76.2 cfs 11.856 af
Primary=76.2 cfs 11.856 af

Link 5AP: Analysis Point 5
Inflow=143.3 cfs 20.685 af
Primary=143.3 cfs 20.685 af

Link 6AP: Analysis Point 6
Inflow=382.9 cfs 50.991 af
Primary=382.9 cfs 50.991 af

Link 7AP: Analysis Point 7
Inflow=106.6 cfs 13.483 af
Primary=106.6 cfs 13.483 af

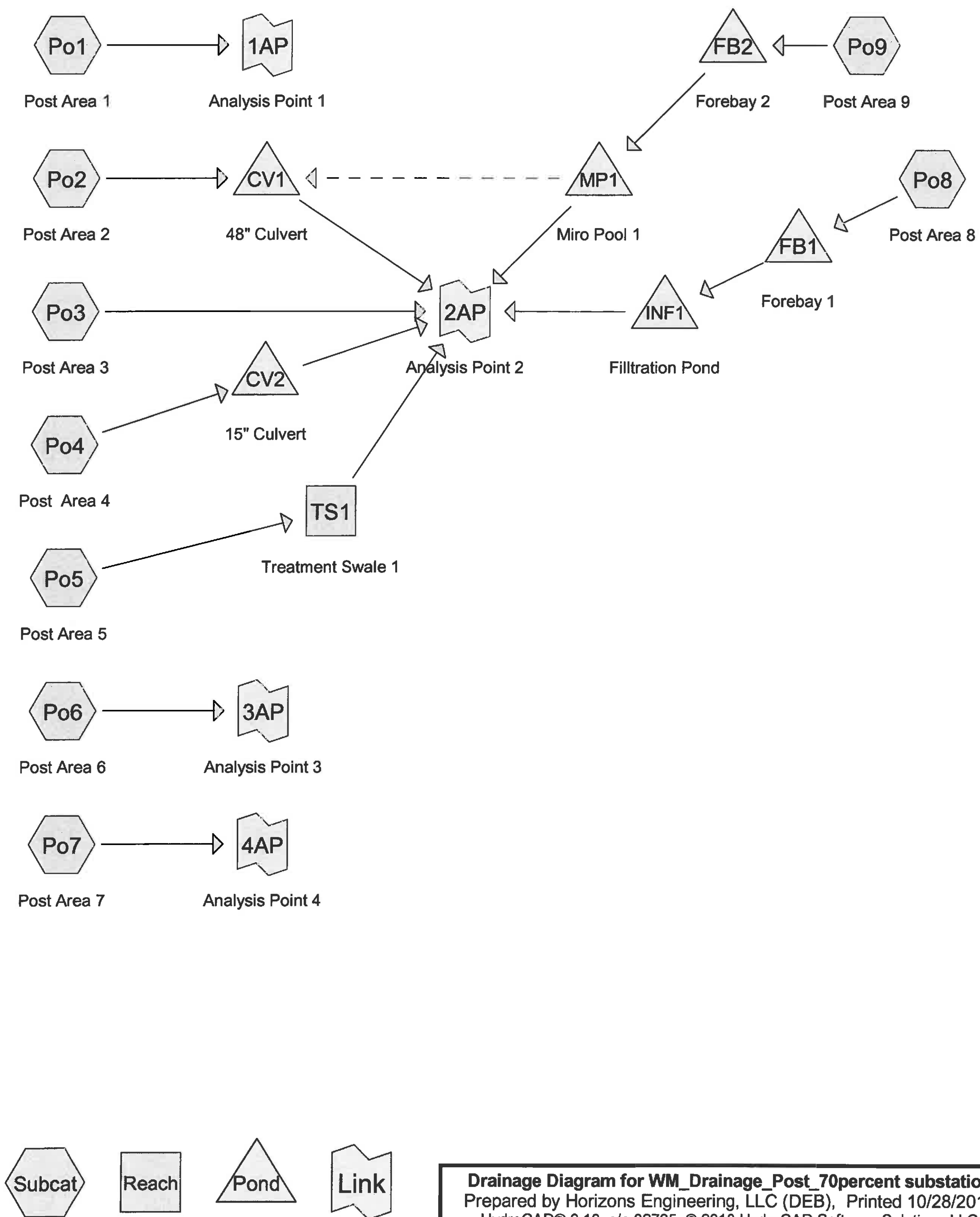
Link 8AP: Analysis Point 8
Inflow=423.1 cfs 55.112 af
Primary=423.1 cfs 55.112 af

Link 9AP: Analysis Point 9
Inflow=1,398.2 cfs 205.166 af
Primary=1,398.2 cfs 205.166 af

Link 10AP: Analysis Point 10
Inflow=1,973.8 cfs 313.918 af
Primary=1,973.8 cfs 313.918 af

Total Runoff Area = 7,098.65 ac Runoff Volume = 1,307.634 af Average Runoff Depth = 2.21"
99.04% Pervious = 7,030.77 ac 0.96% Impervious = 67.88 ac

B. Substation Interconnection Station



Drainage Diagram for WM_Drainage_Post_70percent substation
Prepared by Horizons Engineering, LLC (DEB), Printed 10/28/2013
HydroCAD® 9.10 s/n 02765 © 2010 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.53	30	Meadow, non-grazed, HSG A (Po2, Po4, Po5, Po6, Po7, Po9)
0.36	30	Woods, Good, HSG A (Po2, Po4, Po6)
0.35	55	Woods, Good, HSG B (Po1, Po2, Po3)
0.97	58	Meadow, non-grazed, HSG B (Po1, Po2, Po3, Po4, Po5, Po6, Po9)
41.74	70	Woods, Good, HSG C (Po1, Po2, Po3, Po4, Po6, Po7)
4.17	71	Meadow, non-grazed, HSG C (Po2, Po3, Po4, Po6, Po7, Po8, Po9)
2.57	77	Woods, Good, HSG D (Po1, Po2, Po3, Po4, Po6)
2.51	78	Meadow, non-grazed, HSG D (Po2, Po3, Po4, Po5, Po6, Po8, Po9)
2.01	96	Proposed Roads Gravel (Po4, Po8, Po9)
0.12	98	Proposed Roads Gravel (Po5)
0.25	98	x Paved roads (Po2)
0.01	98	x Roofs (Po2)
0.07	98	x gravel roads (Po3)

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.89	HSG A	Po2, Po4, Po5, Po6, Po7, Po9
1.32	HSG B	Po1, Po2, Po3, Po4, Po5, Po6, Po9
45.91	HSG C	Po1, Po2, Po3, Po4, Po6, Po7, Po8, Po9
5.08	HSG D	Po1, Po2, Po3, Po4, Po5, Po6, Po8, Po9
2.46	Other	Po2, Po3, Po4, Po5, Po8, Po9

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Po1: Post Area 1 Runoff Area=10.86 ac 0.00% Impervious Runoff Depth=0.53"
Flow Length=945' Tc=21.5 min CN=70 Runoff=3.55 cfs 0.479 af

Subcatchment Po2: Post Area 2 Runoff Area=30.22 ac 0.86% Impervious Runoff Depth=0.53"
Flow Length=3,835' Tc=28.0 min CN=70 Runoff=8.92 cfs 1.332 af

Subcatchment Po3: Post Area 3 Runoff Area=2.61 ac 2.68% Impervious Runoff Depth=0.74"
Flow Length=395' Tc=11.6 min CN=75 Runoff=1.71 cfs 0.161 af

Subcatchment Po4: Post Area 4 Runoff Area=2.29 ac 0.00% Impervious Runoff Depth=0.46"
Flow Length=533' Tc=28.0 min CN=68 Runoff=0.54 cfs 0.087 af

Subcatchment Po5: Post Area 5 Runoff Area=0.52 ac 23.08% Impervious Runoff Depth=0.39"
Flow Length=190' Tc=8.9 min CN=66 Runoff=0.14 cfs 0.017 af

Subcatchment Po6: Post Area 6 Runoff Area=5.11 ac 0.00% Impervious Runoff Depth=0.30"
Flow Length=1,120' Tc=20.3 min CN=63 Runoff=0.68 cfs 0.126 af

Subcatchment Po7: Post Area 7 Runoff Area=2.37 ac 0.00% Impervious Runoff Depth=0.36"
Flow Length=511' Tc=11.1 min CN=65 Runoff=0.50 cfs 0.070 af

Subcatchment Po8: Post Area 8 Runoff Area=1.05 ac 0.00% Impervious Runoff Depth=1.59"
Tc=6.1 min CN=89 Runoff=1.94 cfs 0.139 af

Subcatchment Po9: Post Area 9 Runoff Area=1.63 ac 0.00% Impervious Runoff Depth=1.51"
Tc=6.0 min CN=88 Runoff=2.89 cfs 0.205 af

Reach TS1: Treatment Swale 1 Avg. Flow Depth=0.10' Max Vel=0.20 fps Inflow=0.14 cfs 0.017 af
n=0.150 L=120.0' S=0.0100 '/' Capacity=32.38 cfs Outflow=0.11 cfs 0.017 af

Pond CV1: 48" Culvert Peak Elev=624.03' Storage=898 cf Inflow=8.92 cfs 1.332 af
48.0" Round Culvert n=0.015 L=120.0' S=0.1417 '/' Outflow=8.89 cfs 1.332 af

Pond CV2: 15" Culvert Peak Elev=608.10' Storage=7 cf Inflow=0.54 cfs 0.087 af
15.0" Round Culvert n=0.015 L=65.0' S=0.0115 '/' Outflow=0.54 cfs 0.087 af

Pond FB1: Forebay 1 Peak Elev=633.66' Storage=1,561 cf Inflow=1.94 cfs 0.139 af
Outflow=1.86 cfs 0.108 af

Pond FB2: Forebay 2 Peak Elev=624.47' Storage=1,203 cf Inflow=2.89 cfs 0.205 af
Outflow=2.85 cfs 0.182 af

Pond INF1: Filltration Pond Peak Elev=632.93' Storage=1,897 cf Inflow=1.86 cfs 0.108 af
Discarded=0.18 cfs 0.108 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.18 cfs 0.108 af

Pond MP1: Miro Pool 1 Peak Elev=623.59' Storage=4,192 cf Inflow=2.85 cfs 0.182 af
Primary=0.24 cfs 0.168 af Secondary=0.00 cfs 0.000 af Outflow=0.24 cfs 0.168 af

Link 1AP: Analysis Point 1	Inflow=3.55 cfs 0.479 af Primary=3.55 cfs 0.479 af
Link 2AP: Analysis Point 2	Inflow=10.47 cfs 1.764 af Primary=10.47 cfs 1.764 af
Link 3AP: Analysis Point 3	Inflow=0.68 cfs 0.126 af Primary=0.68 cfs 0.126 af
Link 4AP: Analysis Point 4	Inflow=0.50 cfs 0.070 af Primary=0.50 cfs 0.070 af

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Po1: Post Area 1 Runoff Area=10.86 ac 0.00% Impervious Runoff Depth=1.23"
Flow Length=945' Tc=21.5 min CN=70 Runoff=9.61 cfs 1.114 af

Subcatchment Po2: Post Area 2 Runoff Area=30.22 ac 0.86% Impervious Runoff Depth=1.23"
Flow Length=3,835' Tc=28.0 min CN=70 Runoff=23.94 cfs 3.099 af

Subcatchment Po3: Post Area 3 Runoff Area=2.61 ac 2.68% Impervious Runoff Depth=1.56"
Flow Length=395' Tc=11.6 min CN=75 Runoff=3.86 cfs 0.338 af

Subcatchment Po4: Post Area 4 Runoff Area=2.29 ac 0.00% Impervious Runoff Depth=1.11"
Flow Length=533' Tc=28.0 min CN=68 Runoff=1.60 cfs 0.212 af

Subcatchment Po5: Post Area 5 Runoff Area=0.52 ac 23.08% Impervious Runoff Depth=1.00"
Flow Length=190' Tc=8.9 min CN=66 Runoff=0.49 cfs 0.043 af

Subcatchment Po6: Post Area 6 Runoff Area=5.11 ac 0.00% Impervious Runoff Depth=0.84"
Flow Length=1,120' Tc=20.3 min CN=63 Runoff=2.81 cfs 0.357 af

Subcatchment Po7: Post Area 7 Runoff Area=2.37 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=511' Tc=11.1 min CN=65 Runoff=1.92 cfs 0.186 af

Subcatchment Po8: Post Area 8 Runoff Area=1.05 ac 0.00% Impervious Runoff Depth=2.68"
Tc=6.1 min CN=89 Runoff=3.24 cfs 0.235 af

Subcatchment Po9: Post Area 9 Runoff Area=1.63 ac 0.00% Impervious Runoff Depth=2.59"
Tc=6.0 min CN=88 Runoff=4.90 cfs 0.352 af

Reach TS1: Treatment Swale 1 Avg. Flow Depth=0.22' Max Vel=0.33 fps Inflow=0.49 cfs 0.043 af
n=0.150 L=120.0' S=0.0100 '/' Capacity=32.38 cfs Outflow=0.42 cfs 0.043 af

Pond CV1: 48" Culvert Peak Elev=624.75' Storage=1,987 cf Inflow=23.94 cfs 3.099 af
48.0" Round Culvert n=0.015 L=120.0' S=0.1417 '/' Outflow=23.85 cfs 3.099 af

Pond CV2: 15" Culvert Peak Elev=608.38' Storage=15 cf Inflow=1.60 cfs 0.212 af
15.0" Round Culvert n=0.015 L=65.0' S=0.0115 '/' Outflow=1.60 cfs 0.212 af

Pond FB1: Forebay 1 Peak Elev=633.73' Storage=1,656 cf Inflow=3.24 cfs 0.235 af
Outflow=3.16 cfs 0.204 af

Pond FB2: Forebay 2 Peak Elev=624.55' Storage=1,292 cf Inflow=4.90 cfs 0.352 af
Outflow=4.85 cfs 0.329 af

Pond INF1: Filltration Pond Peak Elev=633.54' Storage=3,961 cf Inflow=3.16 cfs 0.204 af
Discarded=0.21 cfs 0.171 af Primary=0.36 cfs 0.033 af Secondary=0.00 cfs 0.000 af Outflow=0.57 cfs 0.204 af

Pond MP1: Miro Pool 1 Peak Elev=624.15' Storage=5,507 cf Inflow=4.85 cfs 0.329 af
Primary=1.96 cfs 0.314 af Secondary=0.00 cfs 0.000 af Outflow=1.96 cfs 0.314 af

Link 1AP: Analysis Point 1	Inflow=9.61 cfs 1.114 af
	Primary=9.61 cfs 1.114 af
Link 2AP: Analysis Point 2	Inflow=29.87 cfs 4.040 af
	Primary=29.87 cfs 4.040 af
Link 3AP: Analysis Point 3	Inflow=2.81 cfs 0.357 af
	Primary=2.81 cfs 0.357 af
Link 4AP: Analysis Point 4	Inflow=1.92 cfs 0.186 af
	Primary=1.92 cfs 0.186 af

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Po1: Post Area 1 Runoff Area=10.86 ac 0.00% Impervious Runoff Depth=2.48"
Flow Length=945' Tc=21.5 min CN=70 Runoff=20.45 cfs 2.248 af

Subcatchment Po2: Post Area 2 Runoff Area=30.22 ac 0.86% Impervious Runoff Depth=2.48"
Flow Length=3,835' Tc=28.0 min CN=70 Runoff=50.73 cfs 6.255 af

Subcatchment Po3: Post Area 3 Runoff Area=2.61 ac 2.68% Impervious Runoff Depth=2.94"
Flow Length=395' Tc=11.6 min CN=75 Runoff=7.46 cfs 0.639 af

Subcatchment Po4: Post Area 4 Runoff Area=2.29 ac 0.00% Impervious Runoff Depth=2.31"
Flow Length=533' Tc=28.0 min CN=68 Runoff=3.55 cfs 0.441 af

Subcatchment Po5: Post Area 5 Runoff Area=0.52 ac 23.08% Impervious Runoff Depth=2.14"
Flow Length=190' Tc=8.9 min CN=66 Runoff=1.15 cfs 0.093 af

Subcatchment Po6: Post Area 6 Runoff Area=5.11 ac 0.00% Impervious Runoff Depth=1.89"
Flow Length=1,120' Tc=20.3 min CN=63 Runoff=7.22 cfs 0.807 af

Subcatchment Po7: Post Area 7 Runoff Area=2.37 ac 0.00% Impervious Runoff Depth=2.06"
Flow Length=511' Tc=11.1 min CN=65 Runoff=4.65 cfs 0.406 af

Subcatchment Po8: Post Area 8 Runoff Area=1.05 ac 0.00% Impervious Runoff Depth=4.34"
Tc=6.1 min CN=89 Runoff=5.13 cfs 0.380 af

Subcatchment Po9: Post Area 9 Runoff Area=1.63 ac 0.00% Impervious Runoff Depth=4.23"
Tc=6.0 min CN=88 Runoff=7.85 cfs 0.575 af

Reach TS1: Treatment Swale 1 Avg. Flow Depth=0.37' Max Vel=0.45 fps Inflow=1.15 cfs 0.093 af
n=0.150 L=120.0' S=0.0100 '/' Capacity=32.38 cfs Outflow=1.04 cfs 0.093 af

Pond CV1: 48" Culvert Peak Elev=625.70' Storage=4,247 cf Inflow=50.73 cfs 6.255 af
48.0" Round Culvert n=0.015 L=120.0' S=0.1417 '/' Outflow=50.43 cfs 6.255 af

Pond CV2: 15" Culvert Peak Elev=608.78' Storage=33 cf Inflow=3.55 cfs 0.441 af
15.0" Round Culvert n=0.015 L=65.0' S=0.0115 '/' Outflow=3.55 cfs 0.441 af

Pond FB1: Forebay 1 Peak Elev=633.92' Storage=1,941 cf Inflow=5.13 cfs 0.380 af
Outflow=4.93 cfs 0.349 af

Pond FB2: Forebay 2 Peak Elev=624.86' Storage=1,654 cf Inflow=7.85 cfs 0.575 af
Outflow=7.27 cfs 0.552 af

Pond INF1: Filltration Pond Peak Elev=633.92' Storage=5,390 cf Inflow=4.93 cfs 0.349 af
Discarded=0.23 cfs 0.210 af Primary=1.55 cfs 0.139 af Secondary=0.00 cfs 0.000 af Outflow=1.78 cfs 0.349 af

Pond MP1: Miro Pool 1 Peak Elev=624.85' Storage=7,479 cf Inflow=7.27 cfs 0.552 af
Primary=3.79 cfs 0.537 af Secondary=0.00 cfs 0.000 af Outflow=3.79 cfs 0.537 af

Link 1AP: Analysis Point 1
Inflow=20.45 cfs 2.248 af
Primary=20.45 cfs 2.248 af

Link 2AP: Analysis Point 2
Inflow=63.42 cfs 8.103 af
Primary=63.42 cfs 8.103 af

Link 3AP: Analysis Point 3
Inflow=7.22 cfs 0.807 af
Primary=7.22 cfs 0.807 af

Link 4AP: Analysis Point 4
Inflow=4.65 cfs 0.406 af
Primary=4.65 cfs 0.406 af

C. Operation and Maintenance Building

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: Post #1.1 Runoff Area=2.11 ac 1.42% Impervious Runoff Depth=1.44"
Flow Length=359' Tc=2.5 min CN=87 Runoff=3.9 cfs 0.253 af

Subcatchment 1.2: Post #1.2 Runoff Area=2.12 ac 2.36% Impervious Runoff Depth=0.94"
Flow Length=553' Tc=18.9 min CN=79 Runoff=1.5 cfs 0.166 af

Subcatchment 1.3: Post #1.3 Runoff Area=0.36 ac 0.00% Impervious Runoff Depth=0.79"
Flow Length=334' Tc=1.2 min CN=76 Runoff=0.3 cfs 0.024 af

Subcatchment 1.4: Post #1.4 Runoff Area=9.05 ac 0.00% Impervious Runoff Depth=0.65"
Flow Length=960' Tc=29.3 min CN=73 Runoff=3.5 cfs 0.491 af

Reach 2R: Reach Avg. Flow Depth=0.05' Max Vel=0.65 fps Inflow=0.3 cfs 0.046 af
n=0.040 L=612.0' S=0.0163 '/' Capacity=181.6 cfs Outflow=0.3 cfs 0.046 af

Reach R1: Reach Avg. Flow Depth=0.23' Max Vel=2.64 fps Inflow=1.3 cfs 0.166 af
n=0.040 L=186.0' S=0.0457 '/' Capacity=45.3 cfs Outflow=1.3 cfs 0.166 af

Pond P1: Filtration Pond Peak Elev=1,355.67' Storage=9,203 cf Inflow=4.3 cfs 0.442 af
Discarded=0.3 cfs 0.396 af Primary=0.3 cfs 0.046 af Secondary=0.0 cfs 0.000 af Outflow=0.6 cfs 0.442 af

Pond WMAC-1.0: WMAC-1.0 Peak Elev=1,357.73' Storage=401 cf Inflow=3.9 cfs 0.253 af
15.0" Round Culvert n=0.015 L=88.0' S=0.0057 '/' Outflow=3.7 cfs 0.253 af

Pond WMAC-2.0: WMAC-2.0 Peak Elev=1,363.04' Storage=719 cf Inflow=1.5 cfs 0.166 af
15.0" Round Culvert n=0.015 L=60.0' S=0.0250 '/' Outflow=1.3 cfs 0.166 af

Link 1AP: Analysis Point 1 Inflow=3.5 cfs 0.537 af
Primary=3.5 cfs 0.537 af

Total Runoff Area = 13.64 ac Runoff Volume = 0.933 af Average Runoff Depth = 0.82"
99.41% Pervious = 13.56 ac 0.59% Impervious = 0.08 ac

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: Post #1.1 Runoff Area=2.11 ac 1.42% Impervious Runoff Depth=2.50"
Flow Length=359' Tc=2.5 min CN=87 Runoff=6.7 cfs 0.439 af

Subcatchment 1.2: Post #1.2 Runoff Area=2.12 ac 2.36% Impervious Runoff Depth=1.84"
Flow Length=553' Tc=18.9 min CN=79 Runoff=3.1 cfs 0.325 af

Subcatchment 1.3: Post #1.3 Runoff Area=0.36 ac 0.00% Impervious Runoff Depth=1.62"
Flow Length=334' Tc=1.2 min CN=76 Runoff=0.7 cfs 0.049 af

Subcatchment 1.4: Post #1.4 Runoff Area=9.05 ac 0.00% Impervious Runoff Depth=1.42"
Flow Length=960' Tc=29.3 min CN=73 Runoff=8.3 cfs 1.071 af

Reach 2R: Reach Avg. Flow Depth=0.18' Max Vel=1.46 fps Inflow=2.5 cfs 0.339 af
n=0.040 L=612.0' S=0.0163 '/' Capacity=181.6 cfs Outflow=2.3 cfs 0.339 af

Reach R1: Reach Avg. Flow Depth=0.35' Max Vel=3.33 fps Inflow=2.5 cfs 0.325 af
n=0.040 L=186.0' S=0.0457 '/' Capacity=45.3 cfs Outflow=2.5 cfs 0.325 af

Pond P1: Filtration Pond Peak Elev=1,356.56' Storage=13,757 cf Inflow=6.8 cfs 0.814 af
Discarded=0.3 cfs 0.475 af Primary=1.0 cfs 0.276 af Secondary=1.5 cfs 0.062 af Outflow=2.8 cfs 0.814 af

Pond WMAC-1.0: WMAC-1.0 Peak Elev=1,358.54' Storage=829 cf Inflow=6.7 cfs 0.439 af
15.0" Round Culvert n=0.015 L=88.0' S=0.0057 '/' Outflow=5.4 cfs 0.439 af

Pond WMAC-2.0: WMAC-2.0 Peak Elev=1,363.30' Storage=1,526 cf Inflow=3.1 cfs 0.325 af
15.0" Round Culvert n=0.015 L=60.0' S=0.0250 '/' Outflow=2.5 cfs 0.325 af

Link 1AP: Analysis Point 1 Inflow=8.6 cfs 1.410 af
Primary=8.6 cfs 1.410 af

Total Runoff Area = 13.64 ac Runoff Volume = 1.885 af Average Runoff Depth = 1.66"
99.41% Pervious = 13.56 ac 0.59% Impervious = 0.08 ac

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: Post #1.1 Runoff Area=2.11 ac 1.42% Impervious Runoff Depth>4.13"
Flow Length=359' Tc=2.5 min CN=87 Runoff=10.9 cfs 0.725 af

Subcatchment 1.2: Post #1.2 Runoff Area=2.12 ac 2.36% Impervious Runoff Depth=3.32"
Flow Length=553' Tc=18.9 min CN=79 Runoff=5.7 cfs 0.586 af

Subcatchment 1.3: Post #1.3 Runoff Area=0.36 ac 0.00% Impervious Runoff Depth=3.03"
Flow Length=334' Tc=1.2 min CN=76 Runoff=1.4 cfs 0.091 af

Subcatchment 1.4: Post #1.4 Runoff Area=9.05 ac 0.00% Impervious Runoff Depth=2.75"
Flow Length=960' Tc=29.3 min CN=73 Runoff=16.6 cfs 2.075 af

Reach 2R: Reach Avg. Flow Depth=0.40' Max Vel=2.31 fps Inflow=9.2 cfs 0.860 af
n=0.040 L=612.0' S=0.0163 '/' Capacity=181.6 cfs Outflow=8.8 cfs 0.860 af

Reach R1: Reach Avg. Flow Depth=0.48' Max Vel=3.95 fps Inflow=4.2 cfs 0.586 af
n=0.040 L=186.0' S=0.0457 '/' Capacity=45.3 cfs Outflow=4.2 cfs 0.586 af

Pond P1: Filtration Pond Peak Elev=1,356.86' Storage=15,561 cf Inflow=10.1 cfs 1.402 af
Discarded=0.4 cfs 0.542 af Primary=1.1 cfs 0.426 af Secondary=8.1 cfs 0.435 af Outflow=9.6 cfs 1.402 af

Pond WMAC-1.0: WMAC-1.0 Peak Elev=1,359.52' Storage=2,098 cf Inflow=10.9 cfs 0.725 af
15.0" Round Culvert n=0.015 L=88.0' S=0.0057 '/' Outflow=7.2 cfs 0.725 af

Pond WMAC-2.0: WMAC-2.0 Peak Elev=1,363.64' Storage=3,042 cf Inflow=5.7 cfs 0.586 af
15.0" Round Culvert n=0.015 L=60.0' S=0.0250 '/' Outflow=4.2 cfs 0.586 af

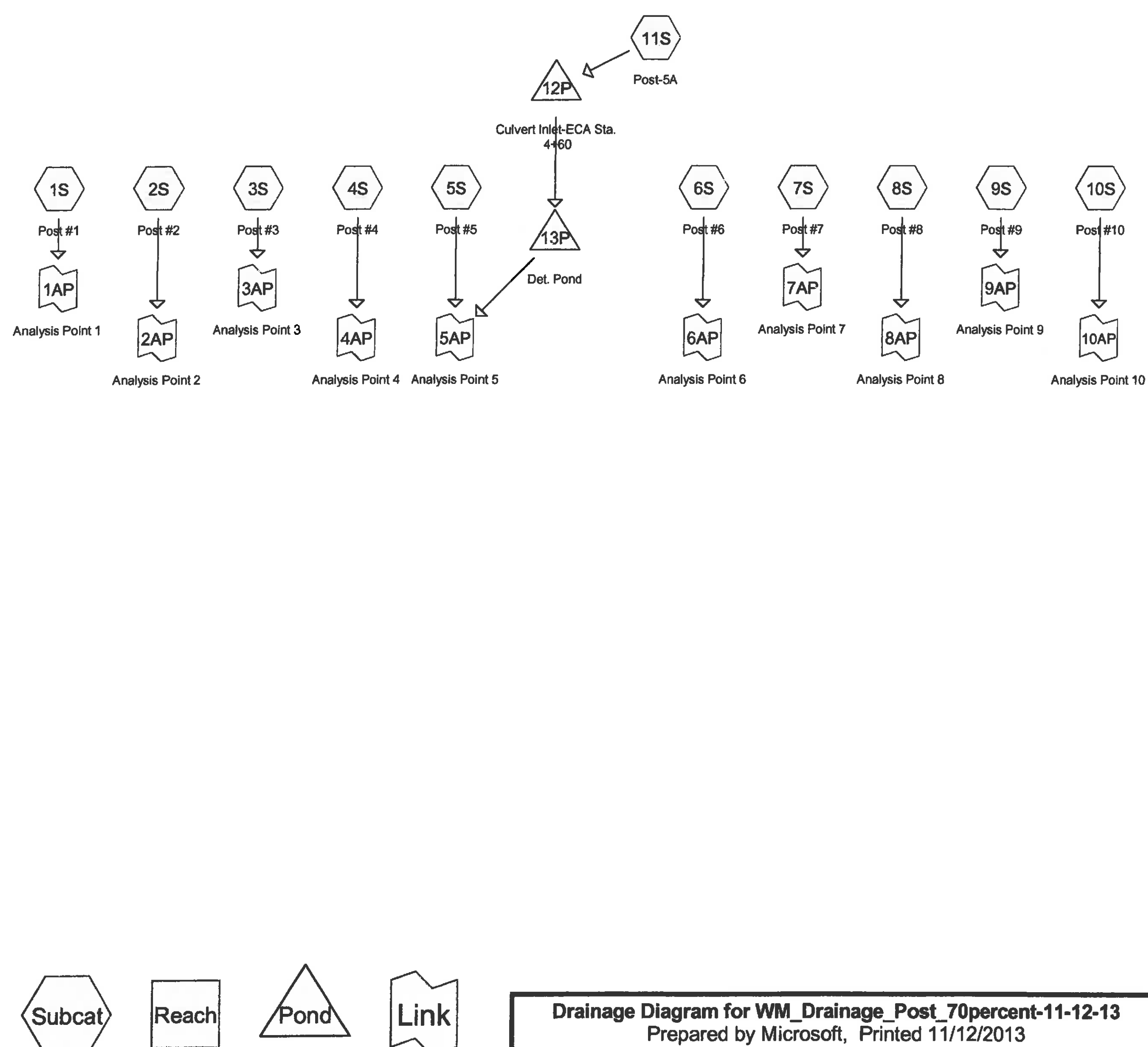
Link 1AP: Analysis Point 1 Inflow=25.4 cfs 2.936 af
Primary=25.4 cfs 2.936 af

Total Runoff Area = 13.64 ac Runoff Volume = 3.477 af Average Runoff Depth = 3.06"
99.41% Pervious = 13.56 ac 0.59% Impervious = 0.08 ac

3.4.2 Post-Development Full Summary Diagram
10 - Year Storm Event

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building

A. Overall Project



Drainage Diagram for WM_Drainage_Post_70percent-11-12-13
Prepared by Microsoft, Printed 11/12/2013
HydroCAD® 9.10 s/n 05478 © 2010 HydroCAD Software Solutions LLC

Project Notes

24-hour rainfall from Northeast Regional Climate Center, 71.796 deg W, 43.581 deg N, elev. 637 ft (Substation location, most conservative)

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.46	30	Meadow, non-grazed, HSG A (1S, 3S, 9S)
0.32	30	Meadow, non-grazed, HSG A-Project (1S)
281.68	30	Woods, Good, HSG A (1S, 3S, 4S, 5S, 9S, 10S)
1.02	51	1 acre lots, 20% imp, HSG A (1S)
1,246.55	55	Woods, Good, HSG B (1S, 2S, 3S, 4S, 5S, 9S, 10S)
24.02	58	Meadow, non-grazed, HSG B (1S, 9S, 10S)
29.10	68	1 acre lots, 20% imp, HSG B (1S, 10S)
4,547.29	70	Woods, Good, HSG C (1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S)
69.75	71	Meadow, non-grazed, HSG C (1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S)
17.06	71	Meadow, non-grazed, HSG C-Project (1S)
686.51	77	Woods, Good, HSG D (1S, 2S, 3S, 4S, 5S, 9S, 10S)
20.37	78	Meadow, non-grazed, HSG D (1S, 2S, 5S, 9S, 10S)
9.52	78	Meadow, non-grazed, HSG D-Project (1S)
62.01	79	1 acre lots, 20% imp, HSG C (1S, 10S)
11.55	96	Gravel (2S, 3S, 4S, 5S, 6S, 7S, 9S, 11S)
1.08	96	Gravel Road Surface, 99% imp, HSG A (1S)
17.86	96	Gravel Road Surface, 99% imp, HSG B (1S, 10S)
30.42	96	Gravel Road Surface, 99% imp, HSG C (1S, 8S, 10S)
0.59	96	Gravel Road Surface, 99% imp, HSG D (1S)
9.94	96	Gravel-Project Road/Pads (1S)
0.12	98	Water Surface, 0% imp, HSG C (11S)
28.44	98	Water Surface, 0% imp, HSG D (1S, 9S)
7,098.65	67	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
287.56	HSG A	1S, 3S, 4S, 5S, 9S, 10S
1,317.52	HSG B	1S, 2S, 3S, 4S, 5S, 9S, 10S
4,726.65	HSG C	1S, 2S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S
745.43	HSG D	1S, 2S, 3S, 4S, 5S, 9S, 10S
21.49	Other	1S, 2S, 3S, 4S, 5S, 6S, 7S, 9S, 11S
7,098.65		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	6S	0.00	0.00	72.0	0.0348	0.015	15.0	0.0	0.0
2	8S	0.00	0.00	139.0	0.0575	0.015	15.0	0.0	0.0
3	8S	0.00	0.00	90.0	0.1780	0.015	15.0	0.0	0.0
4	9S	0.00	0.00	40.0	0.0990	0.012	72.0	42.0	0.0
5	12P	1,990.00	1,972.00	105.0	0.1714	0.015	15.0	0.0	0.0
6	13P	1,977.00	1,971.00	34.8	0.1724	0.015	6.0	0.0	0.0

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post #1 Runoff Area=123,292,544 sf 1.44% Impervious Runoff Depth=1.11"
Flow Length=22,576' Tc=67.2 min CN=68 Runoff=1,233.2 cfs 262.089 af

Subcatchment 2S: Post #2 Runoff Area=18,056,327 sf 0.00% Impervious Runoff Depth=1.05"
Flow Length=6,178' Tc=34.2 min CN=67 Runoff=247.3 cfs 36.394 af

Subcatchment 3S: Post #3 Runoff Area=9,839,787 sf 0.00% Impervious Runoff Depth=0.20"
Flow Length=3,912' Tc=45.0 min CN=47 Runoff=7.6 cfs 3.719 af

Subcatchment 4S: Post #4 Runoff Area=6,114,017 sf 0.00% Impervious Runoff Depth=0.32"
Flow Length=5,139' Tc=27.7 min CN=51 Runoff=14.8 cfs 3.771 af

Subcatchment 5S: Post #5 Runoff Area=7,986,845 sf 0.00% Impervious Runoff Depth=0.47"
Flow Length=6,203' Tc=26.0 min CN=55 Runoff=38.1 cfs 7.202 af

Subcatchment 6S: Post #6 Runoff Area=10,731,231 sf 0.00% Impervious Runoff Depth=1.23"
Flow Length=7,006' Tc=33.0 min CN=70 Runoff=181.0 cfs 25.264 af

Subcatchment 7S: Post #7 Runoff Area=2,837,525 sf 0.00% Impervious Runoff Depth=1.23"
Flow Length=3,296' Tc=29.5 min CN=70 Runoff=50.4 cfs 6.680 af

Subcatchment 8S: Post #8 Runoff Area=11,598,705 sf 1.39% Impervious Runoff Depth=1.23"
Flow Length=7,709' Tc=31.5 min CN=70 Runoff=199.9 cfs 27.307 af

Subcatchment 9S: Post #9 Runoff Area=44,750,937 sf 0.00% Impervious Runoff Depth=1.17"
Flow Length=7,938' Tc=40.0 min CN=69 Runoff=646.6 cfs 100.181 af

Subcatchment 10S: Post #10 Runoff Area=73,747,482 sf 1.39% Impervious Runoff Depth=1.05"
Flow Length=17,365' Tc=45.8 min CN=67 Runoff=869.0 cfs 148.645 af

Subcatchment 11S: Post-5A Runoff Area=261,615 sf 0.00% Impervious Runoff Depth=1.36"
Flow Length=916' Tc=42.9 min CN=72 Runoff=4.3 cfs 0.679 af

Pond 12P: Culvert Inlet-ECA Sta. 4+60 Peak Elev=1,991.49' Storage=83 cf Inflow=4.3 cfs 0.679 af
15.0" Round Culvert n=0.015 L=105.0' S=0.1714 '/' Outflow=4.3 cfs 0.679 af

Pond 13P: Det. Pond Peak Elev=1,977.66' Storage=18,486 cf Inflow=4.3 cfs 0.679 af
Outflow=0.5 cfs 0.354 af

Link 1AP: Analysis Point 1 Inflow=1,233.2 cfs 262.089 af
Primary=1,233.2 cfs 262.089 af

Link 2AP: Analysis Point 2 Inflow=247.3 cfs 36.394 af
Primary=247.3 cfs 36.394 af

Link 3AP: Analysis Point 3 Inflow=7.6 cfs 3.719 af
Primary=7.6 cfs 3.719 af

Link 4AP: Analysis Point 4	Inflow=14.8 cfs 3.771 af Primary=14.8 cfs 3.771 af
Link 5AP: Analysis Point 5	Inflow=38.1 cfs 7.556 af Primary=38.1 cfs 7.556 af
Link 6AP: Analysis Point 6	Inflow=181.0 cfs 25.264 af Primary=181.0 cfs 25.264 af
Link 7AP: Analysis Point 7	Inflow=50.4 cfs 6.680 af Primary=50.4 cfs 6.680 af
Link 8AP: Analysis Point 8	Inflow=199.9 cfs 27.307 af Primary=199.9 cfs 27.307 af
Link 9AP: Analysis Point 9	Inflow=646.6 cfs 100.181 af Primary=646.6 cfs 100.181 af
Link 10AP: Analysis Point 10	Inflow=869.0 cfs 148.645 af Primary=869.0 cfs 148.645 af

Total Runoff Area = 7,098.65 ac Runoff Volume = 621.931 af Average Runoff Depth = 1.05"
99.04% Pervious = 7,030.77 ac 0.96% Impervious = 67.88 ac

Summary for Subcatchment 1S: Post #1

Runoff = 1,233.2 cfs @ 12.98 hrs, Volume= 262.089 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	46,982	96	Gravel Road Surface, 99% imp, HSG A
	112,481	30	Meadow, non-grazed, HSG A
	44,514	51	1 acre lots, 20% imp, HSG A
	1,631,752	30	Woods, Good, HSG A
	527,846	96	Gravel Road Surface, 99% imp, HSG B
	814,537	58	Meadow, non-grazed, HSG B
	398,073	68	1 acre lots, 20% imp, HSG B
	18,556,139	55	Woods, Good, HSG B
	844,537	96	Gravel Road Surface, 99% imp, HSG C
	1,336,187	71	Meadow, non-grazed, HSG C
	1,267,442	79	1 acre lots, 20% imp, HSG C
	83,666,158	70	Woods, Good, HSG C
	25,772	96	Gravel Road Surface, 99% imp, HSG D
	16,152	78	Meadow, non-grazed, HSG D
	11,571,045	77	Woods, Good, HSG D
	828,299	98	Water Surface, 0% imp, HSG D
*	432,831	96	Gravel-Project Road/Pads
*	13,840	30	Meadow, non-grazed, HSG A-Project
*	743,280	71	Meadow, non-grazed, HSG C-Project
*	414,677	78	Meadow, non-grazed, HSG D-Project
	123,292,544	68	Weighted Average
	121,519,853		98.56% Pervious Area
	1,772,691		1.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	100	0.0200	0.07		**Sheet Flow, Sheet Flow 1A** Woods: Light underbrush n= 0.400 P2= 2.65"
10.6	1,058	0.1110	1.67		**Shallow Concentrated Flow, Shallow Conc. 1B** Woodland Kv= 5.0 fps
9.6	5,470	0.0710	9.54	106.68	**Trap/Vee/Rect Channel Flow, Channel Flow 1C** Bot.W=6.00' D=1.30' Z= 2.0 '/' Top.W=11.20' n= 0.040
12.3	7,953	0.0370	10.81	210.99	**Trap/Vee/Rect Channel Flow, Channel Flow 1D** Bot.W=9.00' D=1.60' Z= 2.0 '/' Top.W=15.40' n= 0.030 Stream, clean & straight
11.1	7,995	0.0360	12.05	403.56	**Trap/Vee/Rect Channel Flow, Channel Flow 1E** Bot.W=15.00' D=1.80' Z= 2.0 '/' Top.W=22.20' n= 0.030 Stream, clean & straight
67.2	22,576	Total			

Summary for Subcatchment 2S: Post #2

Runoff = 247.3 cfs @ 12.53 hrs, Volume= 36.394 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	6,795,998	55	Woods, Good, HSG B
	4,022,139	70	Woods, Good, HSG C
	6,910,611	77	Woods, Good, HSG D
*	69,624	96	Gravel
	39,405	71	Meadow, non-grazed, HSG C
	218,550	78	Meadow, non-grazed, HSG D
	18,056,327	67	Weighted Average
	18,056,327		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.1	100	0.0300	0.08		**Sheet Flow, Sheet Flow 2A** Woods: Light underbrush n= 0.400 P2= 2.65"
6.6	737	0.1380	1.86		**Shallow Concentrated Flow, Shallow Flow 2B** Woodland Kv= 5.0 fps
2.6	1,783	0.2370	11.64	33.52	**Trap/Vee/Rect Channel Flow, Channel Flow 1 2C** Bot.W=2.00' D=0.80' Z= 2.0 '/' Top.W=5.20' n= 0.040 Mountain streams
4.9	3,558	0.1380	12.15	109.59	**Trap/Vee/Rect Channel Flow, Channel Flow 2 2D** Bot.W=6.00' D=1.10' Z= 2.0 '/' Top.W=10.40' n= 0.040 Mountain streams
34.2	6,178	Total			

Summary for Subcatchment 3S: Post #3

Runoff = 7.6 cfs @ 13.15 hrs, Volume= 3.719 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	3,818,939	30	Woods, Good, HSG A
	5,249,134	55	Woods, Good, HSG B
	751,073	77	Woods, Good, HSG D
*	4,381	96	Gravel
	16,260	30	Meadow, non-grazed, HSG A
	9,839,787	47	Weighted Average
	9,839,787		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	100	0.1000	0.13		**Sheet Flow, Sheet Flow 3A** Woods: Light underbrush n= 0.400 P2= 2.65"
31.6	3,204	0.1140	1.69		**Shallow Concentrated Flow, Shallow Conc. 3B** Woodland Kv= 5.0 fps
1.0	608	0.1150	9.93	69.74	**Trap/Vee/Rect Channel Flow, Channel Flow 3C** Bot.W=6.00' D=0.90' Z= 2.0 '/' Top.W=9.60' n= 0.040
45.0	3,912	Total			

Summary for Subcatchment 4S: Post #4

Runoff = 14.8 cfs @ 12.64 hrs, Volume= 3.771 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	2,723,965	30	Woods, Good, HSG A
	583,368	55	Woods, Good, HSG B
	2,238,440	70	Woods, Good, HSG C
	428,083	77	Woods, Good, HSG D
*	23,409	96	Gravel
	116,752	71	Meadow, non-grazed, HSG C
	6,114,017	51	Weighted Average
	6,114,017		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	75	0.0500	0.10		**Sheet Flow, Sheet Flow 4A** Woods: Light underbrush n= 0.400 P2= 2.65"
2.2	25	0.4800	0.19		**Sheet Flow, Sheet Flow 4B** Woods: Light underbrush n= 0.400 P2= 2.65"
1.6	270	0.3190	2.82		**Shallow Concentrated Flow, Shallow Conc. 4C** Woodland Kv= 5.0 fps
9.8	4,139	0.1180	7.04	13.52	**Trap/Vee/Rect Channel Flow, Channel Flow 1 4D** Bot.W=2.00' D=0.60' Z= 2.0 '/' Top.W=4.40' n= 0.040
1.1	630	0.1430	9.90	44.33	**Trap/Vee/Rect Channel Flow, Channel Flow 2 4E** Bot.W=4.00' D=0.80' Z= 2.0 '/' Top.W=7.20' n= 0.040
27.7	5,139	Total			

Summary for Subcatchment 5S: Post #5

Runoff = 38.1 cfs @ 12.53 hrs, Volume= 7.202 af, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	2,312,957	30	Woods, Good, HSG A
	2,344,080	55	Woods, Good, HSG B
	2,039,311	70	Woods, Good, HSG C
	1,102,035	77	Woods, Good, HSG D
	14,789	78	Meadow, non-grazed, HSG D
	155,383	71	Meadow, non-grazed, HSG C
*	18,290	96	Gravel
	7,986,845	55	Weighted Average
	7,986,845		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	60	0.1000	0.12		**Sheet Flow, Sheet Flow 5A** Woods: Light underbrush n= 0.400 P2= 2.65"
4.8	40	0.1750	0.14		**Sheet Flow, Sheet Flow 5B** Woods: Light underbrush n= 0.400 P2= 2.65"
0.8	107	0.1800	2.12		**Shallow Concentrated Flow, Shallow Conc. 5C** Woodland Kv= 5.0 fps
7.7	3,770	0.1600	8.20	15.75	**Trap/Vee/Rect Channel Flow, Channel Flow 1 5D** Bot.W=2.00' D=0.60' Z= 2.0 '/' Top.W=4.40' n= 0.040
4.5	2,226	0.1060	8.21	30.22	**Trap/Vee/Rect Channel Flow, Channel Flow 2 5E** Bot.W=3.00' D=0.80' Z= 2.0 '/' Top.W=6.20' n= 0.040
26.0	6,203	Total			

Summary for Subcatchment 6S: Post #6

Runoff = 181.0 cfs @ 12.50 hrs, Volume= 25.264 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	10,612,208	70	Woods, Good, HSG C
	100,464	71	Meadow, non-grazed, HSG C
*	18,559	96	Gravel
	10,731,231	70	Weighted Average
	10,731,231		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.1200	0.14		**Sheet Flow, Sheet Flow 6A** Woods: Light underbrush n= 0.400 P2= 2.65"
1.7	135	0.0670	1.29		**Shallow Concentrated Flow, Shallow Conc. 6B** Woodland Kv= 5.0 fps
0.1	30	0.5000	3.54		**Shallow Concentrated Flow, Shallow Conc 6C** Woodland Kv= 5.0 fps
0.7	65	0.0100	1.61		**Shallow Concentrated Flow, RockSand 6D** Unpaved Kv= 16.1 fps
6.5	225	0.0133	0.58		**Shallow Concentrated Flow, Shallow Con. 6E** Woodland Kv= 5.0 fps
0.4	270	0.0648	11.38	68.27	**Channel Flow, Channel Flow 6F** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030
0.1	72	0.0348	8.51	10.44	**Pipe Channel, Channel 6G** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.015
1.8	110	0.0436	1.04		**Shallow Concentrated Flow, Shallow Conc 6H** Woodland Kv= 5.0 fps
7.6	4,171	0.1750	9.19	19.11	**Trap/Vee/Rect Channel Flow, Channel Flow 1 6I** Bot.W=1.00' D=0.80' Z= 2.0 '/' Top.W=4.20' n= 0.040
2.6	1,828	0.1700	11.72	58.59	**Trap/Vee/Rect Channel Flow, Channel Flow 2 6J** Bot.W=3.00' D=1.00' Z= 2.0 '/' Top.W=7.00' n= 0.040
33.0	7,006	Total			

Summary for Subcatchment 7S: Post #7

Runoff = 50.4 cfs @ 12.45 hrs, Volume= 6.680 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	2,827,725	70	Woods, Good, HSG C
*	1,032	96	Gravel
	8,768	71	Meadow, non-grazed, HSG C
	2,837,525	70	Weighted Average
	2,837,525		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	100	0.0400	0.09		**Sheet Flow, Sheet Flow 7A** Woods: Light underbrush n= 0.400 P2= 2.65"
7.6	1,141	0.2530	2.51		**Shallow Concentrated Flow, Conc. Flow 7B** Woodland Kv= 5.0 fps
4.0	2,055	0.1730	8.53	16.37	**Trap/Vee/Rect Channel Flow, Channel Flow 1 7C** Bot.W=2.00' D=0.60' Z= 2.0 '/' Top.W=4.40' n= 0.040
29.5	3,296	Total			

Summary for Subcatchment 8S: Post #8

Runoff = 199.9 cfs @ 12.48 hrs, Volume= 27.307 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (sf)	CN	Description
162,335	96	Gravel Road Surface, 99% imp, HSG C
10,808,119	70	Woods, Good, HSG C
628,251	71	Meadow, non-grazed, HSG C
11,598,705	70	Weighted Average
11,437,993		98.61% Pervious Area
160,712		1.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0900	0.13		**Sheet Flow, Sheet Flow 8A** Woods: Light underbrush n= 0.400 P2= 2.65"
7.2	600	0.0780	1.40		**Shallow Concentrated Flow, Conc. Flow 8B** Woodland Kv= 5.0 fps
0.2	139	0.0575	10.94	13.42	**Pipe Channel, culvert** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.015
0.6	287	0.1240	8.11	20.12	**Trap/Vee/Rect Channel Flow, Channel Flow 1 8C** Bot.W=1.50' D=0.80' Z= 2.0 '/' Top.W=4.70' n= 0.040 Mountain streams
0.1	90	0.1780	19.25	23.62	**Pipe Channel, culvert** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.015
1.8	1,219	0.2360	11.19	27.76	**Trap/Vee/Rect Channel Flow, Channel Flow 1 8C** Bot.W=1.50' D=0.80' Z= 2.0 '/' Top.W=4.70' n= 0.040 Mountain streams
8.7	5,274	0.1100	10.07	70.50	**Trap/Vee/Rect Channel Flow, Channel Flow 2 8D** Bot.W=5.00' D=1.00' Z= 2.0 '/' Top.W=9.00' n= 0.040 Mountain streams
31.5	7,709	Total			

Summary for Subcatchment 9S: Post #9

Runoff = 646.6 cfs @ 12.61 hrs, Volume= 100.181 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	1,241,921	30	Woods, Good, HSG A
	3,952,345	55	Woods, Good, HSG B
	31,483,358	70	Woods, Good, HSG C
	6,471,473	77	Woods, Good, HSG D
	410,433	98	Water Surface, 0% imp, HSG D
	22,141	30	Meadow, non-grazed, HSG A
	71,374	58	Meadow, non-grazed, HSG B
	282,351	71	Meadow, non-grazed, HSG C
	459,710	78	Meadow, non-grazed, HSG D
*	355,831	96	Gravel
	44,750,937	69	Weighted Average
	44,750,937		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.6	100	0.0800	0.12		**Sheet Flow, Sheet Flow 9A** Woods: Light underbrush n= 0.400 P2= 2.65"
13.7	1,535	0.1390	1.86		**Shallow Concentrated Flow, Shallow Flow 9B** Woodland Kv= 5.0 fps
1.2	339	0.0900	4.89	16.62	**Channel Flow, Channel Flow 9C** Area= 3.4 sf Perim= 11.7' r= 0.29' n= 0.040
0.0	40	0.0990	41.65	874.68	**Pipe Channel, Box Culvert 9D** 72.0" x 42.0" Box Area= 21.0 sf Perim= 19.0' r= 1.11' n= 0.012
2.4	892	0.0910	6.18	11.87	**Trap/Vee/Rect Channel Flow, Channel Flow 1 9E** Bot.W=2.00' D=0.60' Z= 2.0 '/' Top.W=4.40' n= 0.040
3.7	1,377	0.0610	6.23	22.93	**Trap/Vee/Rect Channel Flow, Channel Flow 2 9F** Bot.W=3.00' D=0.80' Z= 2.0 '/' Top.W=6.20' n= 0.040 Mountain streams
5.4	3,655	0.0850	11.26	170.28	**Trap/Vee/Rect Channel Flow, Channel Flow 3 9G** Bot.W=8.00' D=1.40' Z= 2.0 '/' Top.W=13.60' n= 0.040 Mountain streams
40.0	7,938	Total			

Summary for Subcatchment 10S: Post #10

Runoff = 869.0 cfs @ 12.70 hrs, Volume= 148.645 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	540,408	30	Woods, Good, HSG A
	250,180	96	Gravel Road Surface, 99% imp, HSG B
	160,193	58	Meadow, non-grazed, HSG B
	869,410	68	1 acre lots, 20% imp, HSG B
	16,818,573	55	Woods, Good, HSG B
	318,247	96	Gravel Road Surface, 99% imp, HSG C
	302,241	71	Meadow, non-grazed, HSG C
	1,433,541	79	1 acre lots, 20% imp, HSG C
	50,206,452	70	Woods, Good, HSG C
	2,669,993	77	Woods, Good, HSG D
	178,244	78	Meadow, non-grazed, HSG D
	73,747,482	67	Weighted Average
	72,724,149		98.61% Pervious Area
	1,023,333		1.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	100	0.2000	0.18		**Sheet Flow, Sheet Flow 10A** Woods: Light underbrush n= 0.400 P2= 2.65"
4.0	600	0.2500	2.50		**Shallow Concentrated Flow, Shallow Concentration 10B** Woodland Kv= 5.0 fps
10.8	4,291	0.1000	6.61	10.31	**Trap/Vee/Rect Channel Flow, Channel Flow 1 10C** Bot.W=2.00' D=0.60' Z= 1.0 '/' Top.W=3.20' n= 0.040 Earth, dense weeds
8.6	2,450	0.0350	4.75	24.32	**Trap/Vee/Rect Channel Flow, Channel Flow 2 10D** Bot.W=4.00' D=0.80' Z= 3.0 '/' Top.W=8.80' n= 0.040
13.0	9,924	0.0530	12.71	301.02	**Trap/Vee/Rect Channel Flow, Channel Flow 3 10E** Bot.W=10.00' D=1.60' Z= 3.0 '/' Top.W=19.60' n= 0.030 Stream, clean & straight
45.8	17,365	Total			

Summary for Subcatchment 11S: Post-5A

Runoff = 4.3 cfs @ 12.63 hrs, Volume= 0.679 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (sf)	CN	Description
	175,879	70	Woods, Good, HSG C
	68,607	71	Meadow, non-grazed, HSG C
*	12,029	96	Gravel
	5,100	98	Water Surface, 0% imp, HSG C
	261,615	72	Weighted Average
	261,615		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.0600	0.11		**Sheet Flow, Post5A-A** Woods: Light underbrush n= 0.400 P2= 2.65"
27.2	387	0.2100	0.24		**Sheet Flow, Post5A-B** Woods: Light underbrush n= 0.400 P2= 2.65"
0.5	429	0.0900	13.41	80.45	**Channel Flow, Post5A-C** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030
42.9	916	Total			

Summary for Pond 12P: Culvert Inlet-ECA Sta. 4+60

Inflow Area = 6.01 ac, 0.00% Impervious, Inflow Depth = 1.36" for 10 yr event
Inflow = 4.3 cfs @ 12.63 hrs, Volume= 0.679 af
Outflow = 4.3 cfs @ 12.64 hrs, Volume= 0.679 af, Atten= 0%, Lag= 0.5 min
Primary = 4.3 cfs @ 12.64 hrs, Volume= 0.679 af

Routing by Stor-Ind method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Peak Elev= 1,991.49' @ 12.64 hrs Surf.Area= 92 sf Storage= 83 cf

Plug-Flow detention time= 0.3 min calculated for 0.678 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (891.5 - 891.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,990.00'	1,110 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,990.00	20	0	0
1,992.00	116	136	136
1,994.00	510	626	762
1,994.50	880	348	1,110

Device	Routing	Invert	Outlet Devices
#1	Primary	1,990.00'	**15.0" Round Culvert** L= 105.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,990.00' / 1,972.00' S= 0.1714 '/' Cc= 0.900 n= 0.015

Primary OutFlow Max=4.3 cfs @ 12.64 hrs HW=1,991.49' (Free Discharge)
└─**1=Culvert** (Inlet Controls 4.3 cfs @ 3.53 fps)

Summary for Pond 13P: Det. Pond

Inflow Area = 6.01 ac, 0.00% Impervious, Inflow Depth = 1.36" for 10 yr event
Inflow = 4.3 cfs @ 12.64 hrs, Volume= 0.679 af
Outflow = 0.5 cfs @ 15.91 hrs, Volume= 0.354 af, Atten= 88%, Lag= 195.9 min
Primary = 0.5 cfs @ 15.91 hrs, Volume= 0.354 af

Routing by Stor-Ind method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Peak Elev= 1,977.66' @ 15.91 hrs Surf.Area= 4,847 sf Storage= 18,486 cf

Plug-Flow detention time= 443.7 min calculated for 0.354 af (52% of inflow)
Center-of-Mass det. time= 315.8 min (1,207.3 - 891.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,970.00'	38,733 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,970.00	235	0	0
1,972.00	1,280	1,515	1,515
1,974.00	2,440	3,720	5,235
1,976.00	3,705	6,145	11,380
1,978.00	5,080	8,785	20,165
1,980.00	6,550	11,630	31,795
1,981.00	7,325	6,938	38,733

Device	Routing	Invert	Outlet Devices
#1	Primary	1,977.00'	**6.0" Round Culvert** L= 34.8' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,977.00' / 1,971.00' S= 0.1724 '/' Cc= 0.900 n= 0.015
#2	Primary	1,970.00'	**0.7" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.5 cfs @ 15.91 hrs HW=1,977.66' (Free Discharge)
├─**1=Culvert** (Inlet Controls 0.5 cfs @ 2.44 fps)
└─**2=Orifice/Grate** (Orifice Controls 0.0 cfs @ 13.30 fps)

Summary for Link 1AP: Analysis Point 1

Inflow Area = 2,830.41 ac, 1.44% Impervious, Inflow Depth = 1.11" for 10 yr event
Inflow = 1,233.2 cfs @ 12.98 hrs, Volume= 262.089 af
Primary = 1,233.2 cfs @ 12.98 hrs, Volume= 262.089 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 2AP: Analysis Point 2

Inflow Area = 414.52 ac, 0.00% Impervious, Inflow Depth = 1.05" for 10 yr event
Inflow = 247.3 cfs @ 12.53 hrs, Volume= 36.394 af
Primary = 247.3 cfs @ 12.53 hrs, Volume= 36.394 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 3AP: Analysis Point 3

Inflow Area = 225.89 ac, 0.00% Impervious, Inflow Depth = 0.20" for 10 yr event
Inflow = 7.6 cfs @ 13.15 hrs, Volume= 3.719 af
Primary = 7.6 cfs @ 13.15 hrs, Volume= 3.719 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 4AP: Analysis Point 4

Inflow Area = 140.36 ac, 0.00% Impervious, Inflow Depth = 0.32" for 10 yr event
Inflow = 14.8 cfs @ 12.64 hrs, Volume= 3.771 af
Primary = 14.8 cfs @ 12.64 hrs, Volume= 3.771 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 5AP: Analysis Point 5

Inflow Area = 189.36 ac, 0.00% Impervious, Inflow Depth > 0.48" for 10 yr event
Inflow = 38.1 cfs @ 12.53 hrs, Volume= 7.556 af
Primary = 38.1 cfs @ 12.53 hrs, Volume= 7.556 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 6AP: Analysis Point 6

Inflow Area = 246.36 ac, 0.00% Impervious, Inflow Depth = 1.23" for 10 yr event
Inflow = 181.0 cfs @ 12.50 hrs, Volume= 25.264 af
Primary = 181.0 cfs @ 12.50 hrs, Volume= 25.264 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 7AP: Analysis Point 7

Inflow Area = 65.14 ac, 0.00% Impervious, Inflow Depth = 1.23" for 10 yr event
Inflow = 50.4 cfs @ 12.45 hrs, Volume= 6.680 af
Primary = 50.4 cfs @ 12.45 hrs, Volume= 6.680 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 8AP: Analysis Point 8

Inflow Area = 266.27 ac, 1.39% Impervious, Inflow Depth = 1.23" for 10 yr event
Inflow = 199.9 cfs @ 12.48 hrs, Volume= 27.307 af
Primary = 199.9 cfs @ 12.48 hrs, Volume= 27.307 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 9AP: Analysis Point 9

Inflow Area = 1,027.34 ac, 0.00% Impervious, Inflow Depth = 1.17" for 10 yr event
Inflow = 646.6 cfs @ 12.61 hrs, Volume= 100.181 af
Primary = 646.6 cfs @ 12.61 hrs, Volume= 100.181 af, Atten= 0%, Lag= 0.0 min

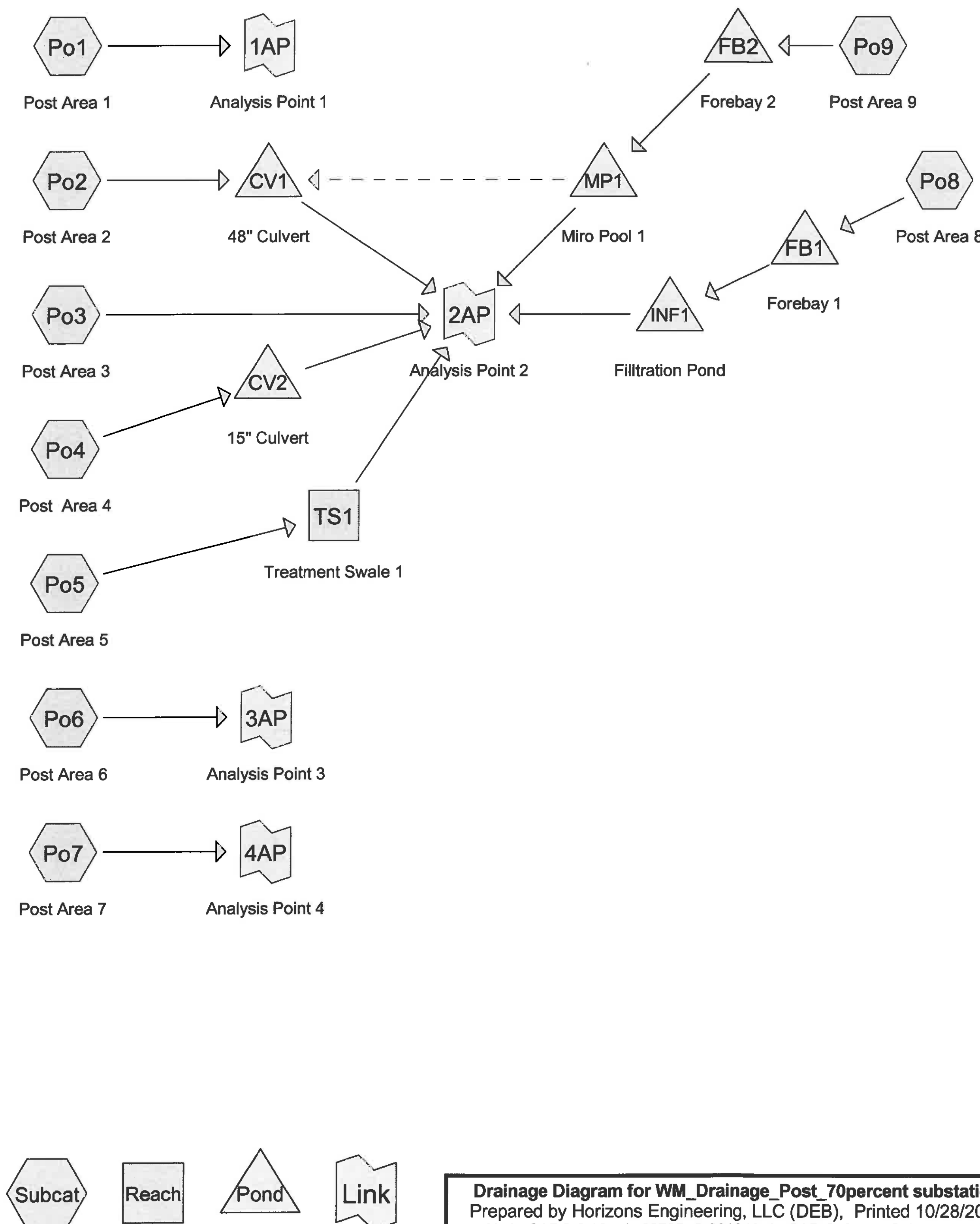
Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

Summary for Link 10AP: Analysis Point 10

Inflow Area = 1,693.01 ac, 1.39% Impervious, Inflow Depth = 1.05" for 10 yr event
Inflow = 869.0 cfs @ 12.70 hrs, Volume= 148.645 af
Primary = 869.0 cfs @ 12.70 hrs, Volume= 148.645 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

B. Substation Interconnection Station



Drainage Diagram for WM_Drainage_Post_70percent substation
Prepared by Horizons Engineering, LLC (DEB), Printed 10/28/2013
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.53	30	Meadow, non-grazed, HSG A (Po2, Po4, Po5, Po6, Po7, Po9)
0.36	30	Woods, Good, HSG A (Po2, Po4, Po6)
0.35	55	Woods, Good, HSG B (Po1, Po2, Po3)
0.97	58	Meadow, non-grazed, HSG B (Po1, Po2, Po3, Po4, Po5, Po6, Po9)
41.74	70	Woods, Good, HSG C (Po1, Po2, Po3, Po4, Po6, Po7)
4.17	71	Meadow, non-grazed, HSG C (Po2, Po3, Po4, Po6, Po7, Po8, Po9)
2.57	77	Woods, Good, HSG D (Po1, Po2, Po3, Po4, Po6)
2.51	78	Meadow, non-grazed, HSG D (Po2, Po3, Po4, Po5, Po6, Po8, Po9)
2.01	96	Proposed Roads Gravel (Po4, Po8, Po9)
0.12	98	Proposed Roads Gravel (Po5)
0.25	98	x Paved roads (Po2)
0.01	98	x Roofs (Po2)
0.07	98	x gravel roads (Po3)
56.66	70	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.89	HSG A	Po2, Po4, Po5, Po6, Po7, Po9
1.32	HSG B	Po1, Po2, Po3, Po4, Po5, Po6, Po9
45.91	HSG C	Po1, Po2, Po3, Po4, Po6, Po7, Po8, Po9
5.08	HSG D	Po1, Po2, Po3, Po4, Po5, Po6, Po8, Po9
2.46	Other	Po2, Po3, Po4, Po5, Po8, Po9
56.66		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	Po2	0.00	0.00	40.0	0.0300	0.025	24.0	0.0	0.0
2	CV1	623.00	606.00	120.0	0.1417	0.015	48.0	0.0	0.0
3	CV2	607.75	607.00	65.0	0.0115	0.015	15.0	0.0	0.0
4	INF1	633.25	625.50	38.0	0.2039	0.015	12.0	0.0	0.0
5	MP1	620.50	606.00	99.0	0.1465	0.015	15.0	0.0	0.0

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment Po1: Post Area 1 Runoff Area=10.86 ac 0.00% Impervious Runoff Depth=1.23"
Flow Length=945' Tc=21.5 min CN=70 Runoff=9.61 cfs 1.114 af

Subcatchment Po2: Post Area 2 Runoff Area=30.22 ac 0.86% Impervious Runoff Depth=1.23"
Flow Length=3,835' Tc=28.0 min CN=70 Runoff=23.94 cfs 3.099 af

Subcatchment Po3: Post Area 3 Runoff Area=2.61 ac 2.68% Impervious Runoff Depth=1.56"
Flow Length=395' Tc=11.6 min CN=75 Runoff=3.86 cfs 0.338 af

Subcatchment Po4: Post Area 4 Runoff Area=2.29 ac 0.00% Impervious Runoff Depth=1.11"
Flow Length=533' Tc=28.0 min CN=68 Runoff=1.60 cfs 0.212 af

Subcatchment Po5: Post Area 5 Runoff Area=0.52 ac 23.08% Impervious Runoff Depth=1.00"
Flow Length=190' Tc=8.9 min CN=66 Runoff=0.49 cfs 0.043 af

Subcatchment Po6: Post Area 6 Runoff Area=5.11 ac 0.00% Impervious Runoff Depth=0.84"
Flow Length=1,120' Tc=20.3 min CN=63 Runoff=2.81 cfs 0.357 af

Subcatchment Po7: Post Area 7 Runoff Area=2.37 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=511' Tc=11.1 min CN=65 Runoff=1.92 cfs 0.186 af

Subcatchment Po8: Post Area 8 Runoff Area=1.05 ac 0.00% Impervious Runoff Depth=2.68"
Tc=6.1 min CN=89 Runoff=3.24 cfs 0.235 af

Subcatchment Po9: Post Area 9 Runoff Area=1.63 ac 0.00% Impervious Runoff Depth=2.59"
Tc=6.0 min CN=88 Runoff=4.90 cfs 0.352 af

Reach TS1: Treatment Swale 1 Avg. Flow Depth=0.22' Max Vel=0.33 fps Inflow=0.49 cfs 0.043 af
n=0.150 L=120.0' S=0.0100 '/' Capacity=32.38 cfs Outflow=0.42 cfs 0.043 af

Pond CV1: 48" Culvert Peak Elev=624.75' Storage=1,987 cf Inflow=23.94 cfs 3.099 af
48.0" Round Culvert n=0.015 L=120.0' S=0.1417 '/' Outflow=23.85 cfs 3.099 af

Pond CV2: 15" Culvert Peak Elev=608.38' Storage=15 cf Inflow=1.60 cfs 0.212 af
15.0" Round Culvert n=0.015 L=65.0' S=0.0115 '/' Outflow=1.60 cfs 0.212 af

Pond FB1: Forebay 1 Peak Elev=633.73' Storage=1,656 cf Inflow=3.24 cfs 0.235 af
Outflow=3.16 cfs 0.204 af

Pond FB2: Forebay 2 Peak Elev=624.55' Storage=1,292 cf Inflow=4.90 cfs 0.352 af
Outflow=4.85 cfs 0.329 af

Pond INF1: Filltration Pond Peak Elev=633.54' Storage=3,961 cf Inflow=3.16 cfs 0.204 af
Discarded=0.21 cfs 0.171 af Primary=0.36 cfs 0.033 af Secondary=0.00 cfs 0.000 af Outflow=0.57 cfs 0.204 af

Pond MP1: Miro Pool 1 Peak Elev=624.15' Storage=5,507 cf Inflow=4.85 cfs 0.329 af
Primary=1.96 cfs 0.314 af Secondary=0.00 cfs 0.000 af Outflow=1.96 cfs 0.314 af

Link 1AP: Analysis Point 1 Inflow=9.61 cfs 1.114 af
Primary=9.61 cfs 1.114 af

Link 2AP: Analysis Point 2 Inflow=29.87 cfs 4.040 af
Primary=29.87 cfs 4.040 af

Link 3AP: Analysis Point 3 Inflow=2.81 cfs 0.357 af
Primary=2.81 cfs 0.357 af

Link 4AP: Analysis Point 4 Inflow=1.92 cfs 0.186 af
Primary=1.92 cfs 0.186 af

Total Runoff Area = 56.66 ac Runoff Volume = 5.936 af Average Runoff Depth = 1.26"
99.21% Pervious = 56.21 ac 0.79% Impervious = 0.45 ac

Summary for Subcatchment Po1: Post Area 1

Runoff = 9.61 cfs @ 12.32 hrs, Volume= 1.114 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (ac)	CN	Description
0.24	55	Woods, Good, HSG B
9.51	70	Woods, Good, HSG C
0.92	77	Woods, Good, HSG D
0.19	58	Meadow, non-grazed, HSG B
10.86	70	Weighted Average
10.86		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	100	0.0900	0.13		**Sheet Flow, Post 1** Woods: Light underbrush n= 0.400 P2= 2.65"
7.2	420	0.1500	0.97		**Shallow Concentrated Flow, Post 1** Forest w/Heavy Litter Kv= 2.5 fps
1.4	425	0.0350	5.04	20.17	**Trap/Vee/Rect Channel Flow, Post 1** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040 Mountain streams
21.5	945	Total			

Summary for Subcatchment Po2: Post Area 2

Runoff = 23.94 cfs @ 12.42 hrs, Volume= 3.099 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.06	30	Woods, Good, HSG A
	0.06	55	Woods, Good, HSG B
	28.42	70	Woods, Good, HSG C
	0.44	77	Woods, Good, HSG D
	0.01	30	Meadow, non-grazed, HSG A
	0.01	58	Meadow, non-grazed, HSG B
	0.73	71	Meadow, non-grazed, HSG C
	0.23	78	Meadow, non-grazed, HSG D
*	0.25	98	x Paved roads
*	0.01	98	x Roofs
*	0.00	96	Proposed Roads Gravel
	30.22	70	Weighted Average
	29.96		99.14% Pervious Area
	0.26		0.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.0	100	0.2200	0.18		**Sheet Flow, Post 2** Woods: Light underbrush n= 0.400 P2= 2.65"
15.7	2,185	0.2150	2.32		**Shallow Concentrated Flow, Post 2** Woodland Kv= 5.0 fps
0.1	40	0.0300	6.49	20.38	**Pipe Channel, Post 2** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.025 Corrugated metal
3.2	1,510	0.0832	7.77	31.10	**Trap/Vee/Rect Channel Flow, Post 2** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040
28.0	3,835	Total			

Summary for Subcatchment Po3: Post Area 3

Runoff = 3.86 cfs @ 12.17 hrs, Volume= 0.338 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.05	55	Woods, Good, HSG B
	0.31	70	Woods, Good, HSG C
	0.48	77	Woods, Good, HSG D
	0.19	58	Meadow, non-grazed, HSG B
	0.31	71	Meadow, non-grazed, HSG C
	1.20	78	Meadow, non-grazed, HSG D
*	0.07	98	x gravel roads
	2.61	75	Weighted Average
	2.54		97.32% Pervious Area
	0.07		2.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	100	0.2400	0.19		**Sheet Flow, Post 3** Woods: Light underbrush n= 0.400 P2= 2.65"
2.9	295	0.1150	1.70		**Shallow Concentrated Flow, Post 3** Woodland Kv= 5.0 fps
11.6	395	Total			

Summary for Subcatchment Po4: Post Area 4

Runoff = 1.60 cfs @ 12.42 hrs, Volume= 0.212 af, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.29	30	Woods, Good, HSG A
	0.37	70	Woods, Good, HSG C
	0.64	77	Woods, Good, HSG D
	0.08	30	Meadow, non-grazed, HSG A
	0.04	58	Meadow, non-grazed, HSG B
	0.24	71	Meadow, non-grazed, HSG C
	0.60	78	Meadow, non-grazed, HSG D
*	0.03	96	Proposed Roads Gravel
	2.29	68	Weighted Average
	2.29		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.6	100	0.0200	0.07		**Sheet Flow, Post 4** Woods: Light underbrush n= 0.400 P2= 2.65"
4.4	433	0.1060	1.63		**Shallow Concentrated Flow, Post 4** Woodland Kv= 5.0 fps
28.0	533	Total			

Summary for Subcatchment Po5: Post Area 5

Runoff = 0.49 cfs @ 12.14 hrs, Volume= 0.043 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.16	30	Meadow, non-grazed, HSG A
	0.06	58	Meadow, non-grazed, HSG B
	0.18	78	Meadow, non-grazed, HSG D
*	0.12	98	Proposed Roads Gravel
	0.52	66	Weighted Average
	0.40		76.92% Pervious Area
	0.12		23.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.2500	0.19		**Sheet Flow, Post 5** Grass: Bermuda n= 0.410 P2= 2.65"
0.1	90	0.0100	10.51	168.11	**Trap/Vee/Rect Channel Flow, Post 5** Bot.W=2.00' D=2.00' Z= 3.0 '/' Top.W=14.00' n= 0.015
8.9	190	Total			

Summary for Subcatchment Po6: Post Area 6

Runoff = 2.81 cfs @ 12.34 hrs, Volume= 0.357 af, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (ac)	CN	Description
0.01	30	Woods, Good, HSG A
3.12	70	Woods, Good, HSG C
0.09	77	Woods, Good, HSG D
0.92	30	Meadow, non-grazed, HSG A
0.21	58	Meadow, non-grazed, HSG B
0.68	71	Meadow, non-grazed, HSG C
0.08	78	Meadow, non-grazed, HSG D
5.11	63	Weighted Average
5.11		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.1200	0.14		**Sheet Flow, Pre 6** Woods: Light underbrush n= 0.400 P2= 2.65"
7.7	780	0.1150	1.70		**Shallow Concentrated Flow, Pre 6** Woodland Kv= 5.0 fps
1.1	240	0.0167	3.48	13.93	**Trap/Vee/Rect Channel Flow, Pre 6** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040
20.3	1,120	Total			

Summary for Subcatchment Po7: Post Area 7

Runoff = 1.92 cfs @ 12.17 hrs, Volume= 0.186 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (ac)	CN	Description
0.01	70	Woods, Good, HSG C
0.33	30	Meadow, non-grazed, HSG A
2.03	71	Meadow, non-grazed, HSG C
2.37	65	Weighted Average
2.37		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.2100	0.18		**Sheet Flow, Post 7** Woods: Light underbrush n= 0.400 P2= 2.65"
1.0	186	0.4100	3.20		**Shallow Concentrated Flow, Post 7** Woodland Kv= 5.0 fps
0.9	225	0.0267	4.40	17.62	**Trap/Vee/Rect Channel Flow, Post 7** Bot.W=2.00' D=1.00' Z= 2.0 '/' Top.W=6.00' n= 0.040
11.1	511	Total			

Summary for Subcatchment Po8: Post Area 8

Runoff = 3.24 cfs @ 12.09 hrs, Volume= 0.235 af, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.16	71	Meadow, non-grazed, HSG C
	0.16	78	Meadow, non-grazed, HSG D
*	0.73	96	Proposed Roads Gravel
	1.05	89	Weighted Average
	1.05		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1					**Direct Entry, Sheet flow less than 5 min**

Summary for Subcatchment Po9: Post Area 9

Runoff = 4.90 cfs @ 12.09 hrs, Volume= 0.352 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.03	30	Meadow, non-grazed, HSG A
	0.27	58	Meadow, non-grazed, HSG B
	0.02	71	Meadow, non-grazed, HSG C
	0.06	78	Meadow, non-grazed, HSG D
*	1.25	96	Proposed Roads Gravel
	1.63	88	Weighted Average
	1.63		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Sheet flow Less than 5 min**

Summary for Reach TS1: Treatment Swale 1

Inflow Area = 0.52 ac, 23.08% Impervious, Inflow Depth = 1.00" for 10 yr event
Inflow = 0.49 cfs @ 12.14 hrs, Volume= 0.043 af
Outflow = 0.42 cfs @ 12.21 hrs, Volume= 0.043 af, Atten= 15%, Lag= 4.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.33 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 0.12 fps, Avg. Travel Time= 17.1 min

Peak Storage= 150 cf @ 12.21 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 2.25', Capacity at Bank-Full= 32.38 cfs

5.00' x 2.25' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/' Top Width= 18.50'
Length= 120.0' Slope= 0.0100 '/'
Inlet Invert= 607.95', Outlet Invert= 606.75'

‡

Summary for Pond CV1: 48" Culvert

Inflow Area = 30.22 ac, 0.86% Impervious, Inflow Depth = 1.23" for 10 yr event
Inflow = 23.94 cfs @ 12.42 hrs, Volume= 3.099 af
Outflow = 23.85 cfs @ 12.45 hrs, Volume= 3.099 af, Atten= 0%, Lag= 1.6 min
Primary = 23.85 cfs @ 12.45 hrs, Volume= 3.099 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 624.75' @ 12.45 hrs Surf.Area= 1,891 sf Storage= 1,987 cf

Plug-Flow detention time= 2.5 min calculated for 3.099 af (100% of inflow)
Center-of-Mass det. time= 2.4 min (885.7 - 883.3)

Volume	Invert	Avail.Storage	Storage Description
#1	623.00'	5,168 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
623.00	625	0	0
624.00	1,100	863	863
626.00	3,205	4,305	5,168

Device	Routing	Invert	Outlet Devices
#1	Primary	623.00'	**48.0" Round Culvert** L= 120.0' CPP, square edge headwall, Ke= 0.500

Inlet / Outlet Invert= 623.00' / 606.00' S= 0.1417 '/' Cc= 0.900
n= 0.015 Corrugated PE, smooth interior

Primary OutFlow Max=23.84 cfs @ 12.45 hrs HW=624.75' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 23.84 cfs @ 4.51 fps)

Summary for Pond CV2: 15" Culvert

Inflow Area = 2.29 ac, 0.00% Impervious, Inflow Depth = 1.11" for 10 yr event
Inflow = 1.60 cfs @ 12.42 hrs, Volume= 0.212 af
Outflow = 1.60 cfs @ 12.43 hrs, Volume= 0.212 af, Atten= 0%, Lag= 0.6 min
Primary = 1.60 cfs @ 12.43 hrs, Volume= 0.212 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 608.38' @ 12.43 hrs Surf.Area= 36 sf Storage= 15 cf

Plug-Flow detention time= 0.5 min calculated for 0.212 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (889.8 - 889.6)

Volume	Invert	Avail.Storage	Storage Description
#1	607.75'	129 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
607.75	15	0	0
608.00	20	4	4
610.00	105	125	129

Device	Routing	Invert	Outlet Devices
#1	Primary	607.75'	**15.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 607.75' / 607.00' S= 0.0115 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior

Primary OutFlow Max=1.60 cfs @ 12.43 hrs HW=608.38' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.60 cfs @ 3.76 fps)

Summary for Pond FB1: Forebay 1

Inflow Area = 1.05 ac, 0.00% Impervious, Inflow Depth = 2.68" for 10 yr event
Inflow = 3.24 cfs @ 12.09 hrs, Volume= 0.235 af
Outflow = 3.16 cfs @ 12.11 hrs, Volume= 0.204 af, Atten= 2%, Lag= 1.1 min
Primary = 3.16 cfs @ 12.11 hrs, Volume= 0.204 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 633.73' @ 12.11 hrs Surf.Area= 1,431 sf Storage= 1,656 cf

Plug-Flow detention time= 91.4 min calculated for 0.204 af (87% of inflow)
Center-of-Mass det. time= 32.8 min (836.8 - 804.0)

Volume	Invert	Avail.Storage	Storage Description
#1	632.00'	6,523 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
632.00	485	0	0
633.00	1,030	758	758
634.00	1,580	1,305	2,063
636.00	2,880	4,460	6,523

Device	Routing	Invert	Outlet Devices
#1	Primary	633.50'	**12.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=3.16 cfs @ 12.11 hrs HW=633.73' TW=632.98' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 3.16 cfs @ 1.15 fps)

Summary for Pond FB2: Forebay 2

Inflow Area = 1.63 ac, 0.00% Impervious, Inflow Depth = 2.59" for 10 yr event
Inflow = 4.90 cfs @ 12.09 hrs, Volume= 0.352 af
Outflow = 4.85 cfs @ 12.10 hrs, Volume= 0.329 af, Atten= 1%, Lag= 0.7 min
Primary = 4.85 cfs @ 12.10 hrs, Volume= 0.329 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 624.55' @ 12.10 hrs Surf.Area= 1,057 sf Storage= 1,292 cf

Plug-Flow detention time= 53.6 min calculated for 0.329 af (93% of inflow)
Center-of-Mass det. time= 18.8 min (826.4 - 807.7)

Volume	Invert	Avail.Storage	Storage Description
#1	622.00'	1,833 cf	**Forebay Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
622.00	120	0	0
624.00	690	810	810
625.00	1,356	1,023	1,833

Device	Routing	Invert	Outlet Devices
#1	Primary	624.25'	**12.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=4.85 cfs @ 12.10 hrs HW=624.55' TW=623.54' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 4.85 cfs @ 1.34 fps)

Summary for Pond INF1: Filltration Pond

Inflow Area = 1.05 ac, 0.00% Impervious, Inflow Depth = 2.33" for 10 yr event
Inflow = 3.16 cfs @ 12.11 hrs, Volume= 0.204 af
Outflow = 0.57 cfs @ 12.58 hrs, Volume= 0.204 af, Atten= 82%, Lag= 28.4 min
Discarded = 0.21 cfs @ 12.58 hrs, Volume= 0.171 af
Primary = 0.36 cfs @ 12.58 hrs, Volume= 0.033 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 633.54' @ 12.58 hrs Surf.Area= 3,664 sf Storage= 3,961 cf

Plug-Flow detention time= 174.8 min calculated for 0.204 af (100% of inflow)
Center-of-Mass det. time= 174.7 min (1,011.5 - 836.8)

Volume	Invert	Avail.Storage	Storage Description
#1	632.25'	18,244 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
632.25	2,455	0	0
634.00	4,090	5,727	5,727
636.00	5,425	9,515	15,242
636.50	6,585	3,003	18,244

Device	Routing	Invert	Outlet Devices
#1	Discarded	632.25'	**2.500 in/hr Exfiltration over Surface area** Phase-In= 0.50'
#2	Secondary	635.00'	**12.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Primary	633.25'	**12.0" Round Culvert** L= 38.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 633.25' / 625.50' S= 0.2039 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior

Discarded OutFlow Max=0.21 cfs @ 12.58 hrs HW=633.54' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=0.36 cfs @ 12.58 hrs HW=633.54' TW=0.00' (Dynamic Tailwater)
3=Culvert (Inlet Controls 0.36 cfs @ 1.85 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=632.25' TW=0.00' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond MP1: Miro Pool 1

Inflow Area = 1.63 ac, 0.00% Impervious, Inflow Depth = 2.42" for 10 yr event
Inflow = 4.85 cfs @ 12.10 hrs, Volume= 0.329 af
Outflow = 1.96 cfs @ 12.33 hrs, Volume= 0.314 af, Atten= 60%, Lag= 14.1 min
Primary = 1.96 cfs @ 12.33 hrs, Volume= 0.314 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Peak Elev= 624.15' @ 12.33 hrs Surf.Area= 2,757 sf Storage= 5,507 cf

Plug-Flow detention time= 306.0 min calculated for 0.314 af (96% of inflow)
Center-of-Mass det. time= 281.8 min (1,108.2 - 826.4)

Volume	Invert	Avail.Storage	Storage Description
#1	616.00'	630 cf	**Micro Pool (Prismatic)** Listed below (Recalc)
#2	620.50'	16,781 cf	**Pond Storage (Prismatic)** Listed below (Recalc)
		17,411 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
616.00	70	0	0
620.50	210	630	630

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
620.50	210	0	0
622.00	1,090	975	975
624.00	2,430	3,520	4,495
626.00	3,960	6,390	10,885
627.00	7,832	5,896	16,781

Device	Routing	Invert	Outlet Devices
#1	Primary	620.50'	**15.0" Round Culvert** L= 99.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 620.50' / 606.00' S= 0.1465 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior
#2	Secondary	625.90'	**8.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Device 1	623.40'	**12.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	620.50'	**1.3" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.96 cfs @ 12.33 hrs HW=624.15' TW=0.00' (Dynamic Tailwater)
└—**1=Culvert** (Passes 1.96 cfs of 10.28 cfs potential flow)
  ├—**3=Orifice/Grate** (Orifice Controls 1.88 cfs @ 2.95 fps)
  └—**4=Orifice/Grate** (Orifice Controls 0.08 cfs @ 9.13 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=616.00' TW=623.00' (Dynamic Tailwater)
└—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link 1AP: Analysis Point 1

Inflow Area = 10.86 ac, 0.00% Impervious, Inflow Depth = 1.23" for 10 yr event
Inflow = 9.61 cfs @ 12.32 hrs, Volume= 1.114 af
Primary = 9.61 cfs @ 12.32 hrs, Volume= 1.114 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Link 2AP: Analysis Point 2

Inflow Area = 38.32 ac, 1.17% Impervious, Inflow Depth = 1.27" for 10 yr event
Inflow = 29.87 cfs @ 12.43 hrs, Volume= 4.040 af
Primary = 29.87 cfs @ 12.43 hrs, Volume= 4.040 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Link 3AP: Analysis Point 3

Inflow Area = 5.11 ac, 0.00% Impervious, Inflow Depth = 0.84" for 10 yr event
Inflow = 2.81 cfs @ 12.34 hrs, Volume= 0.357 af
Primary = 2.81 cfs @ 12.34 hrs, Volume= 0.357 af, Atten= 0%, Lag= 0.0 min

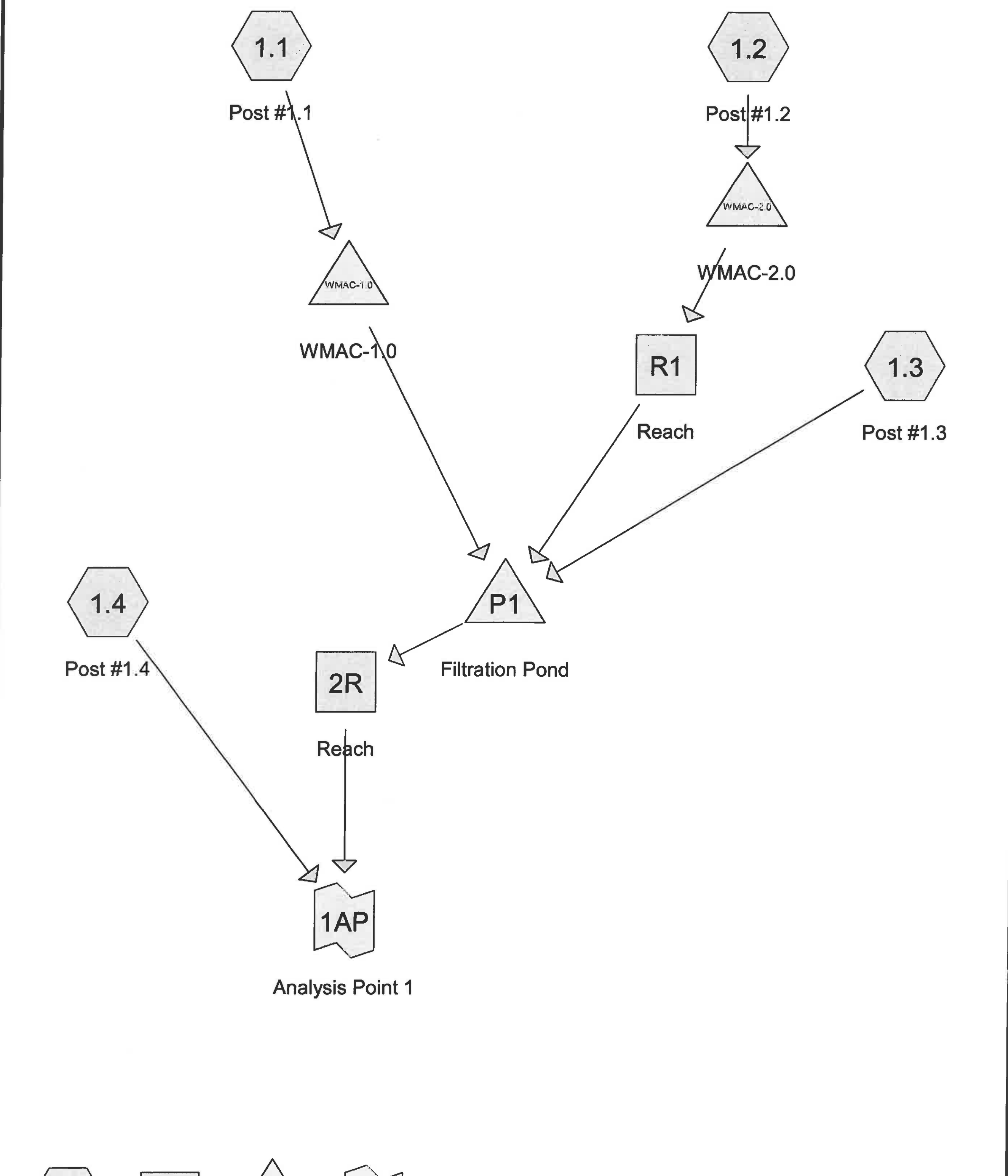
Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

Summary for Link 4AP: Analysis Point 4

Inflow Area = 2.37 ac, 0.00% Impervious, Inflow Depth = 0.94" for 10 yr event
Inflow = 1.92 cfs @ 12.17 hrs, Volume= 0.186 af
Primary = 1.92 cfs @ 12.17 hrs, Volume= 0.186 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs

C. Operation and Maintenance Building



Routing Diagram for O-M_Drainage_Post_70percent
Prepared by Microsoft, Printed 11/15/2013
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Project Notes

24-hour rainfall from Northeast Regional Climate Center, 71.796 deg W, 43.581 deg N, elev. 637 ft (Substation location, most conservative)

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.16	96	Gravel (1.1, 1.2, 1.3, 1.4)
0.08	98	IMP (1.1, 1.2)
5.25	71	Meadow, non-grazed, HSG C (1.1, 1.2, 1.3, 1.4)
2.01	78	Meadow, non-grazed, HSG D (1.4)
4.00	70	Woods, Good, HSG C (1.4)
0.20	77	Woods, Good, HSG D (1.4)
13.70	**76**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.00	HSG A	
0.00	HSG B	
9.25	HSG C	1.1, 1.2, 1.3, 1.4
2.21	HSG D	1.4
2.24	Other	1.1, 1.2, 1.3, 1.4
13.70		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.00	0.00	0.00	0.00	2.16	2.16	Gravel	1.1, 1.2, 1.3, 1.4
0.00	0.00	0.00	0.00	0.08	0.08	IMP	1.1, 1.2
0.00	0.00	5.25	2.01	0.00	7.26	Meadow, non-grazed	1.1, 1.2, 1.3, 1.4
0.00	0.00	4.00	0.20	0.00	4.20	Woods, Good	1.4
0.00	**0.00**	**9.25**	**2.21**	**2.24**	**13.70**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	P1	1,355.02	1,354.00	35.0	0.0291	0.015	12.0	0.0	0.0
2	WMAC-1.0	1,356.50	1,356.00	88.0	0.0057	0.015	15.0	0.0	0.0
3	WMAC-2.0	1,362.50	1,361.00	70.0	0.0214	0.015	15.0	0.0	0.0

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1: Post #1.1 Runoff Area=1.94 ac 1.55% Impervious Runoff Depth=2.41"
Flow Length=359' Tc=2.5 min CN=86 Runoff=6.0 cfs 0.390 af

Subcatchment 1.2: Post #1.2 Runoff Area=2.35 ac 2.13% Impervious Runoff Depth=1.92"
Flow Length=553' Tc=18.9 min CN=80 Runoff=3.6 cfs 0.376 af

Subcatchment 1.3: Post #1.3 Runoff Area=0.36 ac 0.00% Impervious Runoff Depth=1.62"
Flow Length=334' Tc=1.2 min CN=76 Runoff=0.7 cfs 0.049 af

Subcatchment 1.4: Post #1.4 Runoff Area=9.05 ac 0.00% Impervious Runoff Depth=1.42"
Flow Length=960' Tc=29.3 min CN=73 Runoff=8.3 cfs 1.071 af

Reach 2R: Reach Avg. Flow Depth=0.17' Max Vel=1.41 fps Inflow=2.3 cfs 0.339 af
n=0.040 L=612.0' S=0.0163 '/' Capacity=181.6 cfs Outflow=2.1 cfs 0.339 af

Reach R1: Reach Avg. Flow Depth=0.38' Max Vel=3.48 fps Inflow=2.9 cfs 0.376 af
n=0.040 L=186.0' S=0.0457 '/' Capacity=45.3 cfs Outflow=2.9 cfs 0.376 af

Pond P1: Filtration Pond Peak Elev=1,356.64' Storage=14,246 cf Inflow=6.6 cfs 0.814 af
Discarded=0.3 cfs 0.476 af Primary=1.0 cfs 0.291 af Secondary=1.3 cfs 0.047 af Outflow=2.6 cfs 0.814 af

Pond WMAC-1.0: WMAC-1.0 Peak Elev=1,358.37' Storage=693 cf Inflow=6.0 cfs 0.390 af
15.0" Round Culvert n=0.015 L=88.0' S=0.0057 '/' Outflow=5.0 cfs 0.390 af

Pond WMAC-2.0: WMAC-2.0 Peak Elev=1,363.37' Storage=1,794 cf Inflow=3.6 cfs 0.376 af
15.0" Round Culvert n=0.015 L=70.0' S=0.0214 '/' Outflow=2.9 cfs 0.376 af

Link 1AP: Analysis Point 1 Inflow=8.5 cfs 1.410 af
Primary=8.5 cfs 1.410 af

Total Runoff Area = 13.70 ac Runoff Volume = 1.886 af Average Runoff Depth = 1.65"
99.42% Pervious = 13.62 ac 0.58% Impervious = 0.08 ac

Summary for Subcatchment 1.1: Post #1.1

[49] Hint: Tc<2dt may require smaller dt

Runoff = 6.0 cfs @ 12.04 hrs, Volume= 0.390 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	1.16	96	Gravel
	0.75	71	Meadow, non-grazed, HSG C
*	0.03	98	IMP
	1.94	86	Weighted Average
	1.91		98.45% Pervious Area
	0.03		1.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	100	0.0100	0.95		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.65"
0.5	139	0.0600	4.97		**Shallow Concentrated Flow, Shallow Conc.** Paved Kv= 20.3 fps
0.2	120	0.0500	8.83	106.00	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.040
2.5	359	Total			

Summary for Subcatchment 1.2: Post #1.2

Runoff = 3.6 cfs @ 12.27 hrs, Volume= 0.376 af, Depth= 1.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

	Area (ac)	CN	Description
	0.83	96	Gravel
	1.47	71	Meadow, non-grazed, HSG C
*	0.05	98	IMP
	2.35	80	Weighted Average
	2.30		97.87% Pervious Area
	0.05		2.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0500	0.15		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 2.65"
8.0	453	0.0180	0.94		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
18.9	553	Total			

Summary for Subcatchment 1.3: Post #1.3

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.7 cfs @ 12.03 hrs, Volume= 0.049 af, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (ac)	CN	Description
0.07	96	Gravel
0.29	71	Meadow, non-grazed, HSG C
0.36	76	Weighted Average
0.36		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	18	0.0200	0.89		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.65"
0.2	38	0.1800	2.97		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
0.7	278	0.0300	6.84	82.10	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.040
1.2	334	Total			

Summary for Subcatchment 1.4: Post #1.4

Runoff = 8.3 cfs @ 12.44 hrs, Volume= 1.071 af, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.85"

Area (ac)	CN	Description
0.10	96	Gravel
2.74	71	Meadow, non-grazed, HSG C
4.00	70	Woods, Good, HSG C
2.01	78	Meadow, non-grazed, HSG D
0.20	77	Woods, Good, HSG D
9.05	73	Weighted Average
9.05		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	100	0.0700	0.18		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 2.65"
1.7	140	0.0400	1.40		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
6.7	380	0.0360	0.95		**Shallow Concentrated Flow, Shallow Conc.** Woodland Kv= 5.0 fps
11.4	340	0.0050	0.49		**Shallow Concentrated Flow, Shallow Conc.** Short Grass Pasture Kv= 7.0 fps
29.3	960	Total			

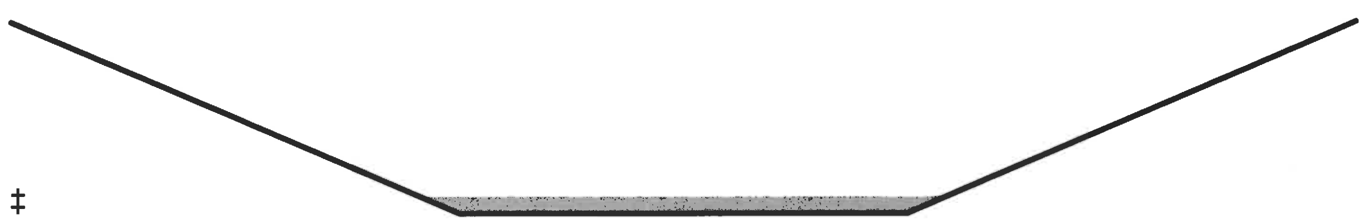
Summary for Reach 2R: Reach

Inflow Area = 4.65 ac, 1.72% Impervious, Inflow Depth = 0.87" for 10 yr event
Inflow = 2.3 cfs @ 12.79 hrs, Volume= 0.339 af
Outflow = 2.1 cfs @ 13.01 hrs, Volume= 0.339 af, Atten= 6%, Lag= 13.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 1.41 fps, Min. Travel Time= 7.3 min
Avg. Velocity = 0.65 fps, Avg. Travel Time= 15.7 min

Peak Storage= 928 cf @ 12.89 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 2.00' Flow Area= 32.0 sf, Capacity= 181.6 cfs

8.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 4.0 '/' Top Width= 24.00'
Length= 612.0' Slope= 0.0163 '/'
Inlet Invert= 1,350.00', Outlet Invert= 1,340.00'



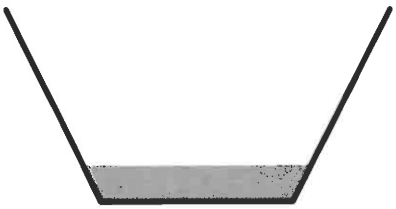
Summary for Reach R1: Reach

Inflow Area = 2.35 ac, 2.13% Impervious, Inflow Depth = 1.92" for 10 yr event
Inflow = 2.9 cfs @ 12.42 hrs, Volume= 0.376 af
Outflow = 2.9 cfs @ 12.45 hrs, Volume= 0.376 af, Atten= 0%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Max. Velocity= 3.48 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.21 fps, Avg. Travel Time= 2.6 min

Peak Storage= 153 cf @ 12.43 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 2.00' Flow Area= 6.0 sf, Capacity= 45.3 cfs

2.00' x 2.00' deep channel, n= 0.040
Side Slope Z-value= 0.5 '/' Top Width= 4.00'
Length= 186.0' Slope= 0.0457 '/'
Inlet Invert= 1,360.50', Outlet Invert= 1,352.00'



Summary for Pond P1: Filtration Pond

[62] Hint: Exceeded Reach R1 OUTLET depth by 4.40' @ 13.05 hrs
[79] Warning: Submerged Pond WMAC-1.0 Primary device # 1 INLET by 0.14'

Inflow Area =	4.65 ac,	1.72% Impervious, Inflow Depth = 2.10"	for 10 yr event
Inflow =	6.6 cfs @	12.09 hrs, Volume=	0.814 af
Outflow =	2.6 cfs @	12.79 hrs, Volume=	0.814 af, Atten= 61%, Lag= 42.1 min
Discarded =	0.3 cfs @	12.79 hrs, Volume=	0.476 af
Primary =	1.0 cfs @	12.79 hrs, Volume=	0.291 af
Secondary =	1.3 cfs @	12.79 hrs, Volume=	0.047 af

Routing by Stor-Ind method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Peak Elev= 1,356.64' @ 12.79 hrs Surf.Area= 5,843 sf Storage= 14,246 cf
Flood Elev= 1,358.00' Surf.Area= 7,545 sf Storage= 22,771 cf

Plug-Flow detention time= 258.4 min calculated for 0.813 af (100% of inflow)
Center-of-Mass det. time= 258.9 min (1,095.9 - 837.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,354.00'	1,961 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc)
#2	1,353.00'	20,810 cf	**INFILTRATION-GRV (Prismatic)** Listed below (Recalc)
		22,771 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,354.00	110	0	0
1,356.00	460	570	570
1,357.50	1,395	1,391	1,961

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,353.00	2,450	0	0
1,354.00	3,050	2,750	2,750
1,356.00	4,430	7,480	10,230
1,358.00	6,150	10,580	20,810

Device	Routing	Invert	Outlet Devices
#1	Primary	1,355.02'	**12.0" Round Culvert** L= 35.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,355.02' / 1,354.00' S= 0.0291 '/' Cc= 0.900 n= 0.015, Flow Area= 0.79 sf
#2	Secondary	1,356.50'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#3	Device 1	1,355.52'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Discarded	1,353.00'	**2.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.3 cfs @ 12.79 hrs HW=1,356.64' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.3 cfs)

Primary OutFlow Max=1.0 cfs @ 12.79 hrs HW=1,356.64' (Free Discharge)
└─**1=Culvert** (Passes 1.0 cfs of 4.0 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 1.0 cfs @ 5.10 fps)

Secondary OutFlow Max=1.2 cfs @ 12.79 hrs HW=1,356.64' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.2 cfs @ 0.88 fps)

Summary for Pond WMAC-1.0: WMAC-1.0

Inflow Area =	1.94 ac,	1.55% Impervious, Inflow Depth = 2.41"	for 10 yr event
Inflow =	6.0 cfs @	12.04 hrs, Volume=	0.390 af
Outflow =	5.0 cfs @	12.09 hrs, Volume=	0.390 af, Atten= 16%, Lag= 2.6 min
Primary =	5.0 cfs @	12.09 hrs, Volume=	0.390 af

Routing by Stor-Ind method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Peak Elev= 1,358.37' @ 12.08 hrs Surf.Area= 697 sf Storage= 693 cf
Flood Elev= 1,360.00' Surf.Area= 2,180 sf Storage= 3,044 cf

Plug-Flow detention time= 5.2 min calculated for 0.390 af (100% of inflow)
Center-of-Mass det. time= 4.6 min (816.1 - 811.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,356.50'	3,044 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,356.50	300	0	0
1,358.00	365	499	499
1,360.00	2,180	2,545	3,044

Device	Routing	Invert	Outlet Devices
#1	Primary	1,356.50'	**15.0" Round Culvert** L= 88.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,356.50' / 1,356.00' S= 0.0057 '/' Cc= 0.900 n= 0.015, Flow Area= 1.23 sf

Primary OutFlow Max=5.0 cfs @ 12.09 hrs HW=1,358.32' (Free Discharge)
└─**1=Culvert** (Barrel Controls 5.0 cfs @ 4.04 fps)

Summary for Pond WMAC-2.0: WMAC-2.0

Inflow Area =	2.35 ac,	2.13% Impervious,	Inflow Depth = 1.92"	for 10 yr event	
Inflow =	3.6 cfs @	12.27 hrs,	Volume=	0.376 af	
Outflow =	2.9 cfs @	12.42 hrs,	Volume=	0.376 af,	Atten= 21%, Lag= 9.4 min
Primary =	2.9 cfs @	12.42 hrs,	Volume=	0.376 af	

Routing by Stor-Ind method, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Peak Elev= 1,363.37' @ 12.42 hrs Surf.Area= 4,018 sf Storage= 1,794 cf
Flood Elev= 1,366.00' Surf.Area= 19,277 sf Storage= 31,393 cf

Plug-Flow detention time= 10.0 min calculated for 0.375 af (100% of inflow)
Center-of-Mass det. time= 10.0 min (855.6 - 845.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,362.50'	31,393 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,362.50	125	0	0
1,364.00	6,870	5,246	5,246
1,366.00	19,277	26,147	31,393

Device	Routing	Invert	Outlet Devices
#1	Primary	1,362.50'	**15.0" Round Culvert** L= 70.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,362.50' / 1,361.00' S= 0.0214 '/' Cc= 0.900 n= 0.015, Flow Area= 1.23 sf

Primary OutFlow Max=2.9 cfs @ 12.42 hrs HW=1,363.36' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.9 cfs @ 3.16 fps)

Summary for Link 1AP: Analysis Point 1

Inflow Area =	13.70 ac,	0.58% Impervious,	Inflow Depth = 1.24"	for 10 yr event	
Inflow =	8.5 cfs @	12.46 hrs,	Volume=	1.410 af	
Primary =	8.5 cfs @	12.46 hrs,	Volume=	1.410 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs

3.5 Stone Riprap Calculations
(Energy Dissipation – Stability Calculations)

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building

A. Overall Project

Stone Fill Sizing - Calculations 25 year storm

13185 Wild Meadows Wind Project

Performed By: CJH
Checked By: AJC
Date: 11/21/2013

Channel Protection - Stone Sizing =

$$d50 = 12\ [118 \times Q \times Sb^{13/6} \times R/P]^{2/5}$$

Where Sb = Slope Channel Bottom R = Hydraulic Radius

Q=Discharge from pipe CFS P = Wetted Perimeter

Channel Protection SD-1

	CFS	Feet/Feet	Feet	Feet
Data:	Q= 2.75	Sb= 0.129	R= 0.202	P= 3.12

d50= 0.57 Feet

Use Erosion Stone

Summary for Subcatchment SD-1: ECAS 81+50

Runoff = 2.75 cfs @ 12.56 hrs, Volume= 0.360 af, Depth> 1.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=4.76"

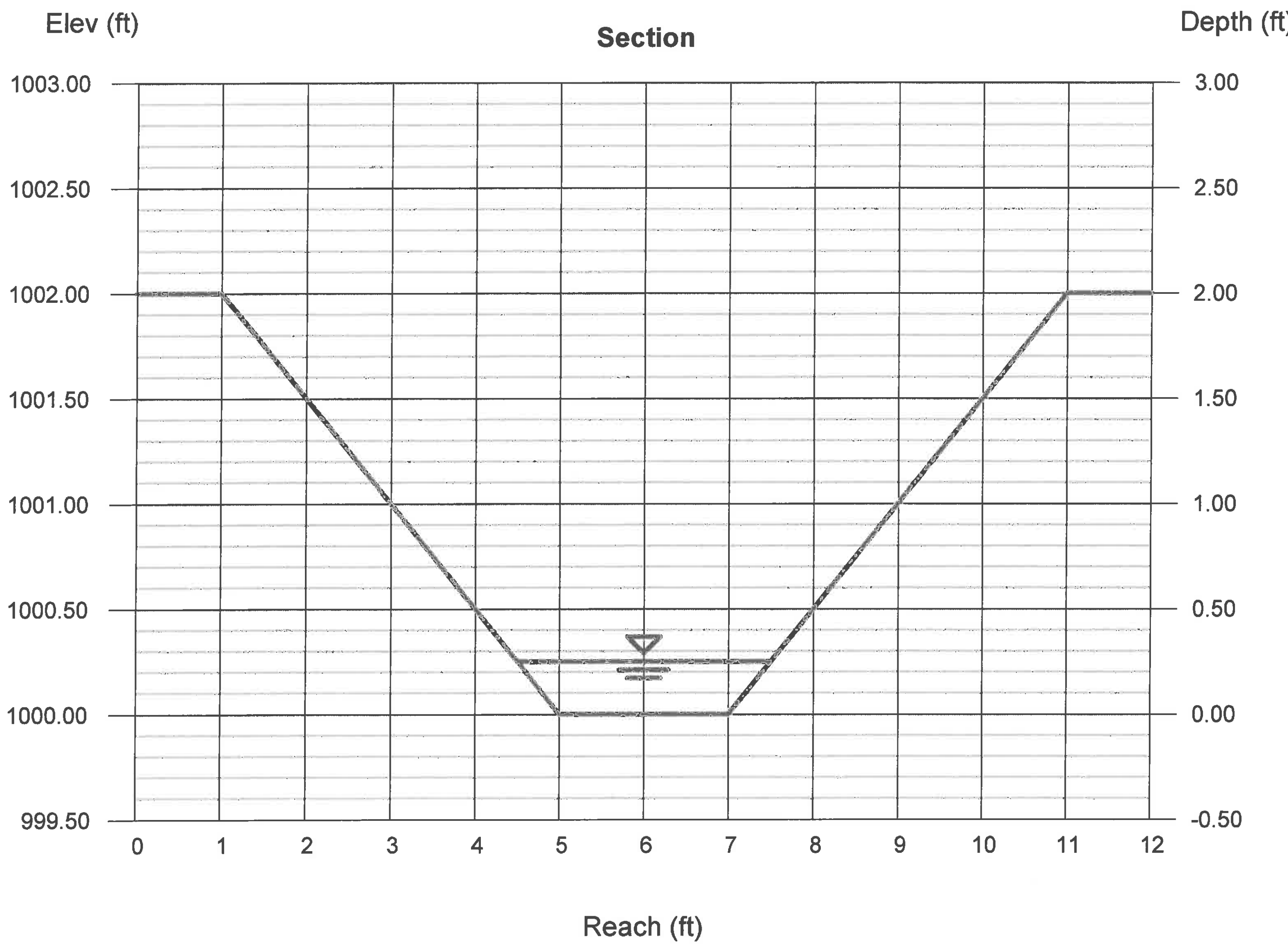
	Area (sf)	CN	Description
*	3,689	96	Gravel
	22,455	71	Meadow, non-grazed, HSG C
	80,720	70	Woods, Good, HSG C
	106,864	71	Weighted Average
	106,864		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.1	100	0.0100	0.05		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
1.5	187	0.1660	2.04		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.3	104	0.1250	6.57	9.86	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
0.1	50	0.0200	6.45	7.92	**Pipe Channel, D** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.015 Corrugated PE, smooth interior
4.8	663	0.2130	2.31		**Shallow Concentrated Flow, E** Woodland Kv= 5.0 fps
0.4	178	0.1290	6.68	10.02	**Trap/Vee/Rect Channel Flow, F** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
38.2	1,282	Total			

Channel Report

SD-1

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.25
Side Slopes (z:1)	= 2.00, 2.00	Q (cfs)	= 2.750
Total Depth (ft)	= 2.00	Area (sqft)	= 0.63
Invert Elev (ft)	= 1000.00	Velocity (ft/s)	= 4.40
Slope (%)	= 12.90	Wetted Perim (ft)	= 3.12
N-Value	= 0.040	Crit Depth, Yc (ft)	= 0.35
		Top Width (ft)	= 3.00
Calculations		EGL (ft)	= 0.55
Compute by:	Known Q		
Known Q (cfs)	= 2.75		



Stone Fill Sizing - Calculations 25 year storm

13185 Wild Meadows Wind Project

Performed By: CJH
Checked By: AJC
Date: 11/21/2013

Channel Protection - Stone Sizing =

$$d50 = 12\ [118 \times Q \times Sb^{13/6} \times R/P]^{2/5}$$

Where Sb = Slope Channel Bottom R = Hydraulic Radius

Q=Discharge from pipe CFS P = Wetted Perimeter

Channel Protection SD-2

	CFS	Feet/Feet	Feet	Feet
Data:	Q= 6.99	Sb= 0.043	R= 0.389	P= 4.5

d50= 0.36 Feet

Use Erosion Stone

Summary for Subcatchment SD-2: ECAS 78+75

Runoff = 6.99 cfs @ 12.10 hrs, Volume= 0.475 af, Depth> 1.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=4.76"

	Area (sf)	CN	Description
*	6,458	96	Gravel
	22,388	71	Meadow, non-grazed, HSG C
	110,383	70	Woods, Good, HSG C
	139,229	71	Weighted Average
	139,229		100.00% Pervious Area

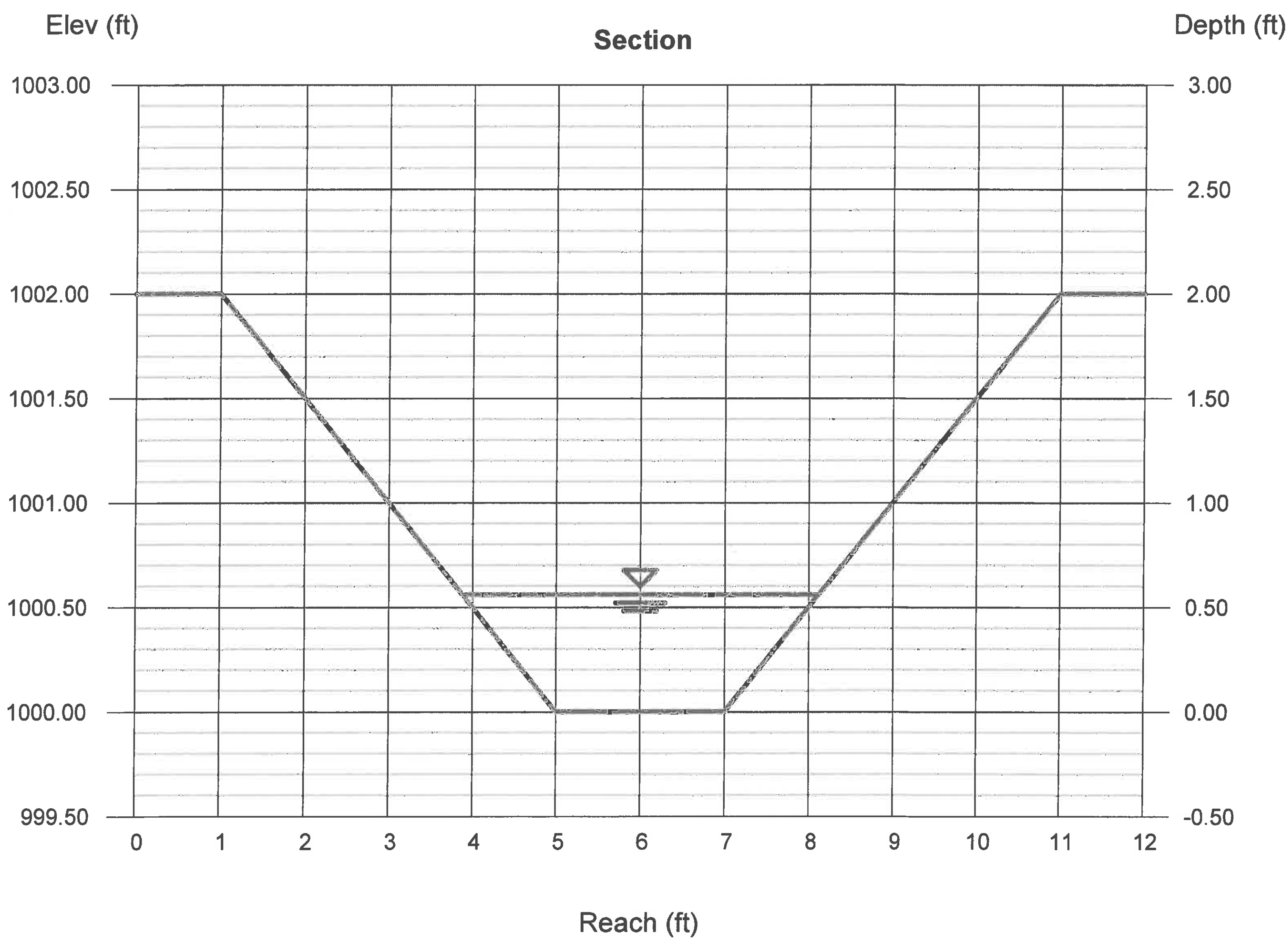
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0420	1.68		**Sheet Flow, A** Smooth surfaces n= 0.011 P2= 2.65"
3.9	700	0.1870	3.03		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
1.2	282	0.0430	3.86	5.78	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
6.1	1,082	Total			

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. — Thursday, Nov 21 2013

SD-2

Trapezoidal		Highlighted	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.56
Side Slopes (z:1)	= 2.00, 2.00	Q (cfs)	= 6.990
Total Depth (ft)	= 2.00	Area (sqft)	= 1.75
Invert Elev (ft)	= 1000.00	Velocity (ft/s)	= 4.00
Slope (%)	= 4.30	Wetted Perim (ft)	= 4.50
N-Value	= 0.040	Crit Depth, Yc (ft)	= 0.60
		Top Width (ft)	= 4.24
Calculations		EGL (ft)	= 0.81
Compute by:	Known Q		
Known Q (cfs)	= 6.99		



Stone Fill Sizing - Calculations 25 year storm

13185 Wild Meadows Wind Project

Performed By: CJH
Checked By: AJC
Date: 11/21/2013

Channel Protection - Stone Sizing =

$$d50 = 12\,[118 \times Q \times Sb^{13/6} \times R/P]^{2/5}$$

Where Sb = Slope Channel Bottom R = Hydraulic Radius

Q=Discharge from pipe CFS P = Wetted Perimeter

Channel Protection SD-3

	CFS	Feet/Feet	Feet	Feet
Data:	Q= 8.27	Sb= 0.043	R= 0.41	P= 4.68

d50= 0.39 Feet

Use Erosion Stone

Summary for Subcatchment SD-3: CEC 52+40

Runoff = 8.27 cfs @ 12.24 hrs, Volume= 0.763 af, Depth> 1.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=4.76"

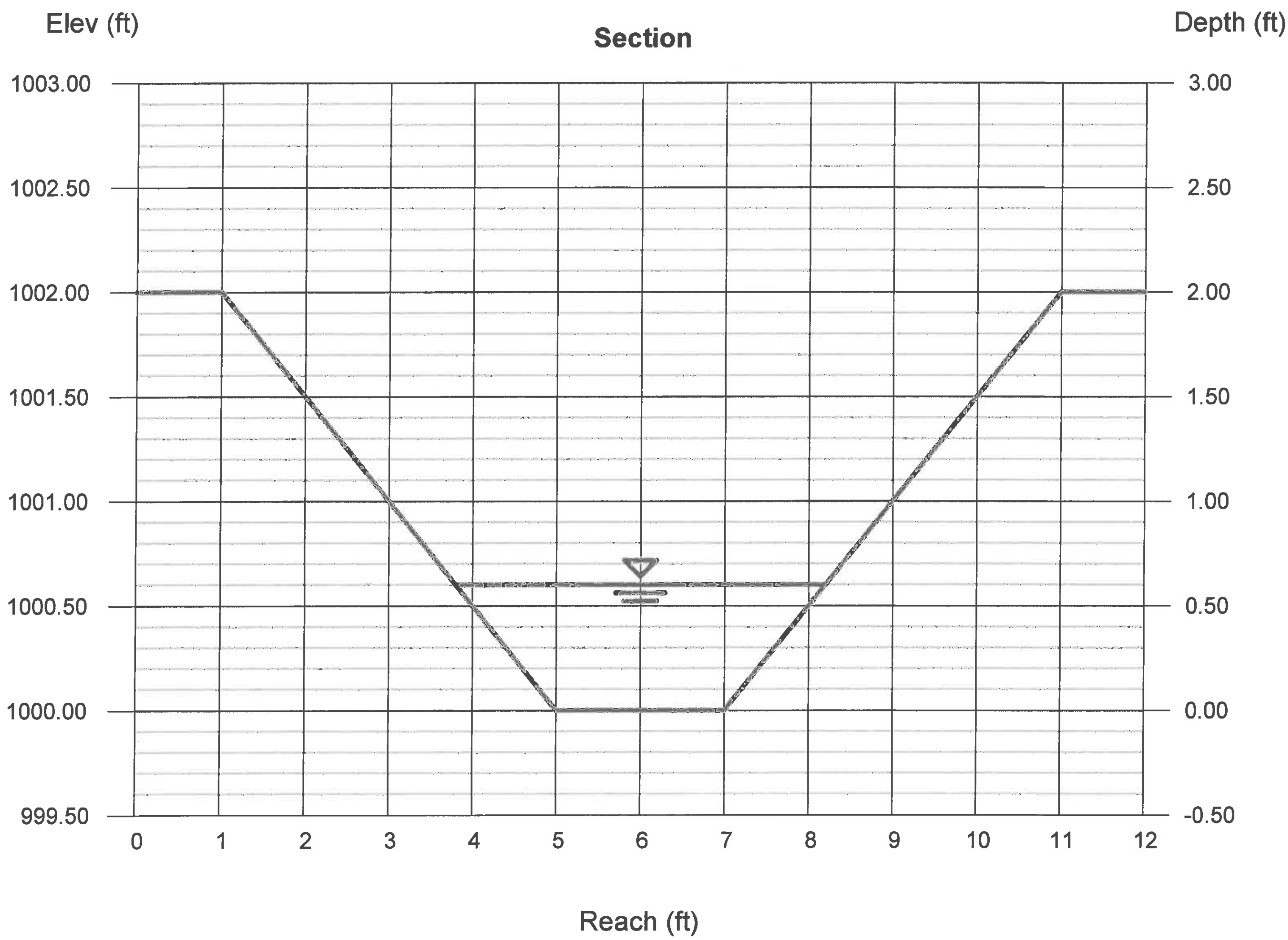
	Area (sf)	CN	Description
*	3,531	96	Gravel
*	115	96	Gravel
	4,858	71	Meadow, non-grazed, HSG C
	701	78	Meadow, non-grazed, HSG D
	213,705	70	Woods, Good, HSG C
	1,587	77	Woods, Good, HSG D
	224,497	71	Weighted Average
	224,497		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	100	0.1500	0.16		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
4.8	707	0.2400	2.45		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
1.3	323	0.0460	3.99	5.98	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
16.6	1,130	Total			

Channel Report

SD-3

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.60
Side Slopes (z:1)	= 2.00, 2.00	Q (cfs)	= 8.270
Total Depth (ft)	= 2.00	Area (sqft)	= 1.92
Invert Elev (ft)	= 1000.00	Velocity (ft/s)	= 4.31
Slope (%)	= 4.60	Wetted Perim (ft)	= 4.68
N-Value	= 0.040	Crit Depth, Yc (ft)	= 0.65
		Top Width (ft)	= 4.40
Calculations		EGL (ft)	= 0.89
Compute by:	Known Q		
Known Q (cfs)	= 8.27		



Stone Fill Sizing - Calculations 25 year storm

13185 Wild Meadows Wind Project

Performed By: CJH
Checked By: AJC
Date: 11/21/2013

Channel Protection - Stone Sizing =

$$d50 = 12\,[118 \times Q \times Sb^{13/6} \times R/P]^{2/5}$$

Where Sb = Slope Channel Bottom R = Hydraulic Radius

Q=Discharge from pipe CFS P = Wetted Perimeter

Channel Protection SD-4

	CFS	Feet/Feet	Feet	Feet
Data:	Q= 1.71	Sb= 0.129	R= 0.158	P= 2.85

d50= 0.45 Feet

Use Erosion Stone

Summary for Subcatchment SD-4: ECAS 6+50

Runoff = 1.71 cfs @ 12.16 hrs, Volume= 0.137 af, Depth> 1.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 yr Rainfall=4.76"

	Area (sf)	CN	Description
*	2,547	96	Gravel
	11,359	71	Meadow, non-grazed, HSG C
	24,597	70	Woods, Good, HSG C
	38,503	72	Weighted Average
	38,503		100.00% Pervious Area

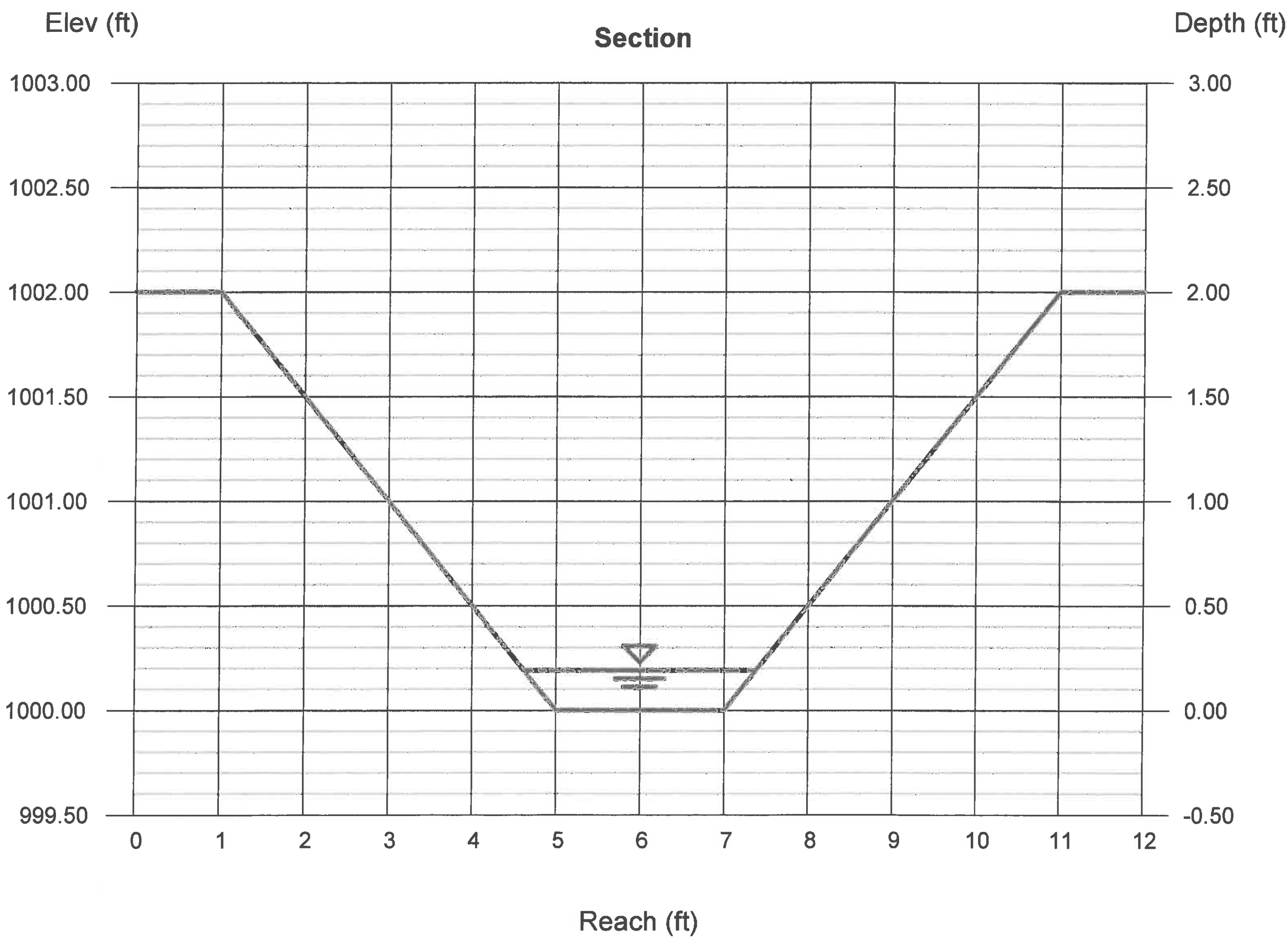
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	100	0.2100	0.18		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
1.4	143	0.1120	1.67		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.7	263	0.1290	6.68	10.02	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=0.50' Z= 2.0 '/' Top.W=4.00' n= 0.040
11.3	506	Total			

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. — Thursday, Nov 21 2013

SD-4

Trapezoidal		Highlighted	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.19
Side Slopes (z:1)	= 2.00, 2.00	Q (cfs)	= 1.710
Total Depth (ft)	= 2.00	Area (sqft)	= 0.45
Invert Elev (ft)	= 1000.00	Velocity (ft/s)	= 3.78
Slope (%)	= 12.90	Wetted Perim (ft)	= 2.85
N-Value	= 0.040	Crit Depth, Yc (ft)	= 0.26
		Top Width (ft)	= 2.76
Calculations		EGL (ft)	= 0.41
Compute by:	Known Q		
Known Q (cfs)	= 1.71		



Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Monday, Nov 11 2013

WMAC-0.1

* Invert Elev Dn (ft)	=	1101.50
Pipe Length (ft)	=	117.00
Slope (%)	=	0.43
Invert Elev Up (ft)	=	1102.00
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1105.60
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

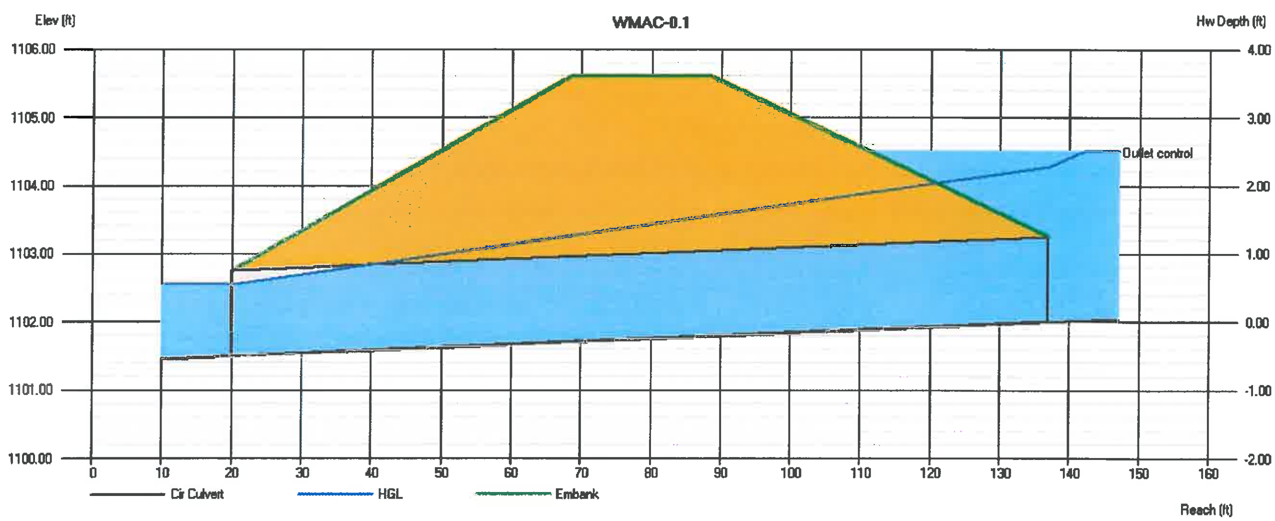
Calculations

Qmin (cfs)	=	6.00
Qmax (cfs)	=	7.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	6.60
Qpipe (cfs)	=	6.60
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.07
Veloc Up (ft/s)	=	5.38
* HGL Dn (ft)	=	1102.54
HGL Up (ft)	=	1104.27
Hw Elev (ft)	=	1104.49
Hw/D (ft)	=	2.00
Flow Regime	=	Outlet Control

1102.54 - 1101.50 = 1.04



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width
Q=Discharge from pipe CFS Tw=Tailwater

Culvert-WMAC-0.1 Outlet Protection

Data:	Q= (CFS)	D= (Feet)	Tw= (Feet)	Channel (Y or N)
	6.6	1.25	1.04	N

1) Apron Width at Outlet
   Use Eq 3 — 4 Feet

2) Apron Length
   Use Eq 2 — 23 Feet

3) Downstream Apron Width
   Use Eq 5 — 13 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.19 Feet

Use NHDOT Class C Stone Fill

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Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CAS-1.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 19.7	D= 2	Tw= 0.92	N

1) Apron Width at Outlet
   Use Eq 3 6 Feet

2) Apron Length
   Use Eq 1 27 Feet

3) Downstream Apron Width
   Use Eq 4 33 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.58 Feet

Use Erosion Stone

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Thursday, Nov 7 2013

CAS-1.0

Invert Elev Dn (ft)	=	1455.50
Pipe Length (ft)	=	75.00
Slope (%)	=	6.00
Invert Elev Up (ft)	=	1460.00
Rise (in)	=	24.0
Shape	=	Cir
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1466.00
Top Width (ft)	=	0.00
Crest Width (ft)	=	0.00

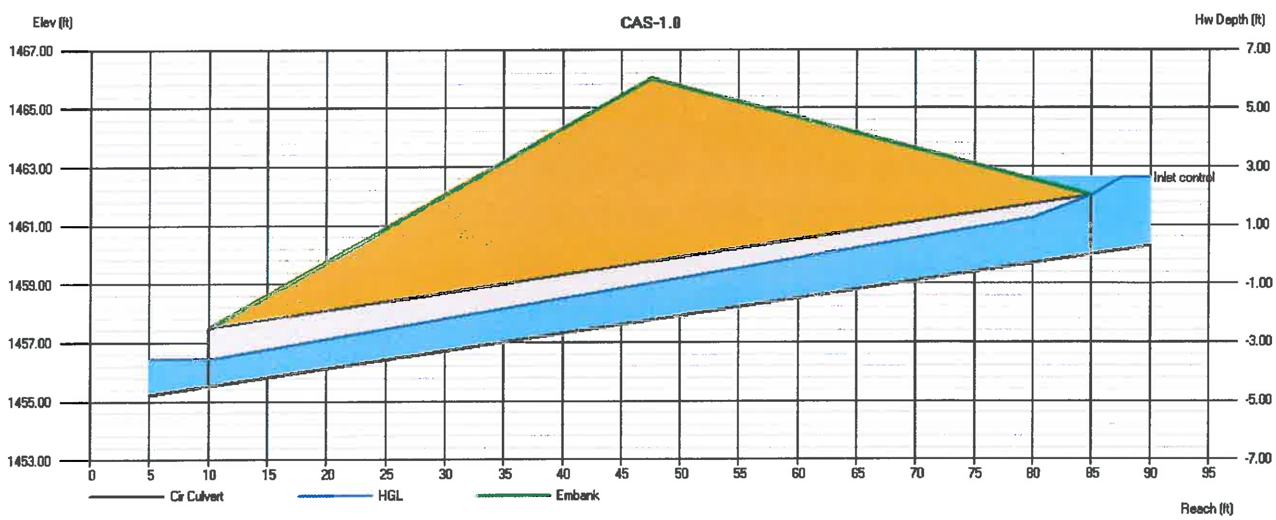
Calculations

Qmin (cfs)	=	19.00
Qmax (cfs)	=	20.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	19.70
Qpipe (cfs)	=	19.70
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	13.88
Veloc Up (ft/s)	=	7.31
HGL Dn (ft)	=	1456.42
HGL Up (ft)	=	1461.60
Hw Elev (ft)	=	1462.60
Hw/D (ft)	=	1.30
Flow Regime	=	Inlet Control

1456.42 - 1455.50 = 0.92



Stone Fill Sizing - Outlet Protection
Calculations 50 year storm

Project:	13185 WM
Performed By:	AJC
Checked By:	
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

CV-CCN-2.0 Sta. 14+80 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 13.6	D= 1.25	Tw= 1.23	n

1) Apron Width at Outlet
Use Eq 3 4 Feet

2) Apron Length
Use Eq 2 38 Feet

3) Downstream Apron Width
Use Eq 5 19 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \ \ x D}$$

0.42 Feet

Use Erosion Stone

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Wednesday, Oct 23 2013

CCN-2.0

Invert Elev Dn (ft)	=	2042.00 **
Pipe Length (ft)	=	83.00
Slope (%)	=	4.83
Invert Elev Up (ft)	=	2046.01
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2053.40
Top Width (ft)	=	40.00
Crest Width (ft)	=	100.00

Calculations

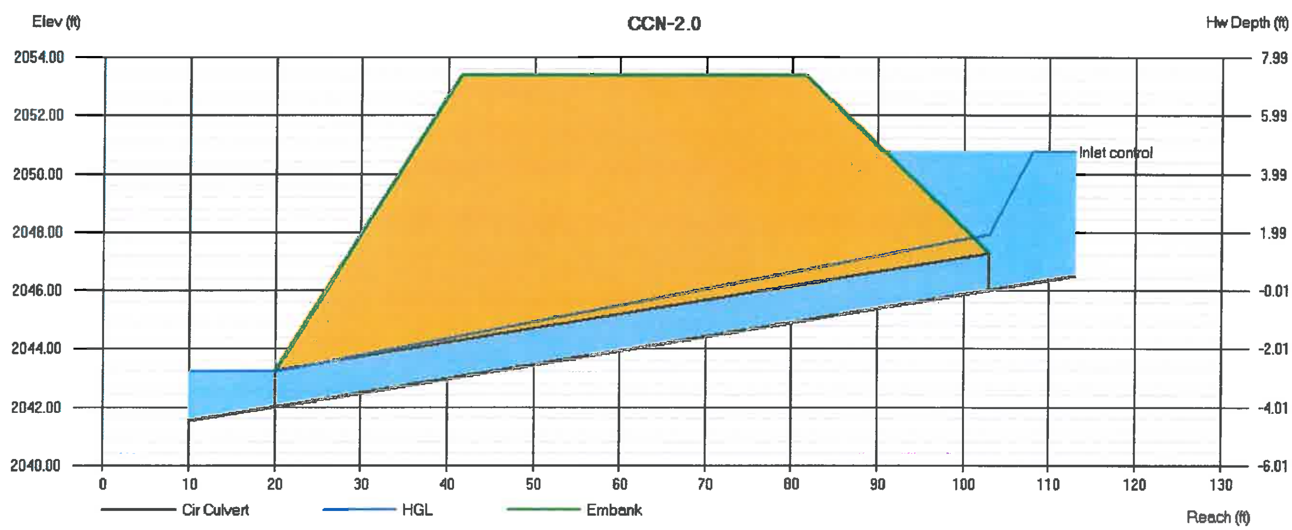
Qmin (cfs)	=	13.60
Qmax (cfs)	=	13.60
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	13.60
Qpipe (cfs)	=	13.60
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	11.12
Veloc Up (ft/s)	=	11.08
HGL Dn (ft)	=	2043.23 *
HGL Up (ft)	=	2047.91
Hw Elev (ft)	=	2050.74
Hw/D (ft)	=	3.78
Flow Regime	=	Inlet Control

* - ** = TW

2043.23 - 2042.0 = 1.23'



Stone Fill Sizing - Outlet Protection
Calculations 50 year storm

Project:	13185 WM
Performed By:	AJC
Checked By:	
Date:	10/23/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

CV-CCN-1.0 Sta. 4+50 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 11.5	D= 1.25	Tw= 1.21	n

1) Apron Width at Outlet
Use Eq 3 4 Feet

2) Apron Length
Use Eq 2 33 Feet

3) Downstream Apron Width
Use Eq 5 17 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.34 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Oct 23 2013

CCN-1.0

Invert Elev Dn (ft)	=	2085.00 *
Pipe Length (ft)	=	56.00
Slope (%)	=	2.68
Invert Elev Up (ft)	=	2086.50
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2090.00
Top Width (ft)	=	40.00
Crest Width (ft)	=	100.00

Calculations

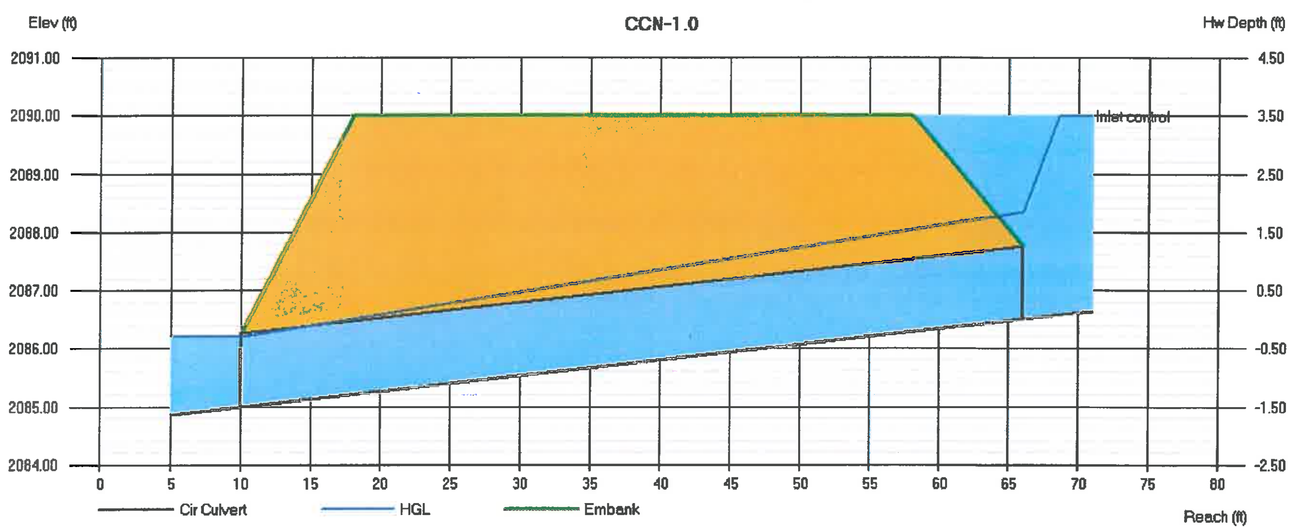
Qmin (cfs)	=	11.50
Qmax (cfs)	=	11.50
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	11.50
Qpipe (cfs)	=	11.20
Qovertop (cfs)	=	0.30
Veloc Dn (ft/s)	=	9.23
Veloc Up (ft/s)	=	9.13
HGL Dn (ft)	=	2086.21 *
HGL Up (ft)	=	2088.34
Hw Elev (ft)	=	2089.99
Hw/D (ft)	=	2.79
Flow Regime	=	Inlet Control

* − * = TW

2086.21 − 2085.0 = 1.21'



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	CJH
Checked By:	AJC
Date:	11/1/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-12.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 6	D= 1.25	Tw= 0.51	N

1) Apron Width at Outlet

   Use Eq 3 — 4 Feet

2) Apron Length

   Use Eq 1 — 16 Feet

3) Downstream Apron Width

   Use Eq 4 — 20 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.34 Feet

Use NHDOT Class C Stone Fill

Culvert Report

CEC-12.0

Invert Elev Dn (ft)	=	1885.00
Pipe Length (ft)	=	63.00
Slope (%)	=	9.89
Invert Elev Up (ft)	=	1891.23
Rise (in)	=	15.0
Shape	=	Circular
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

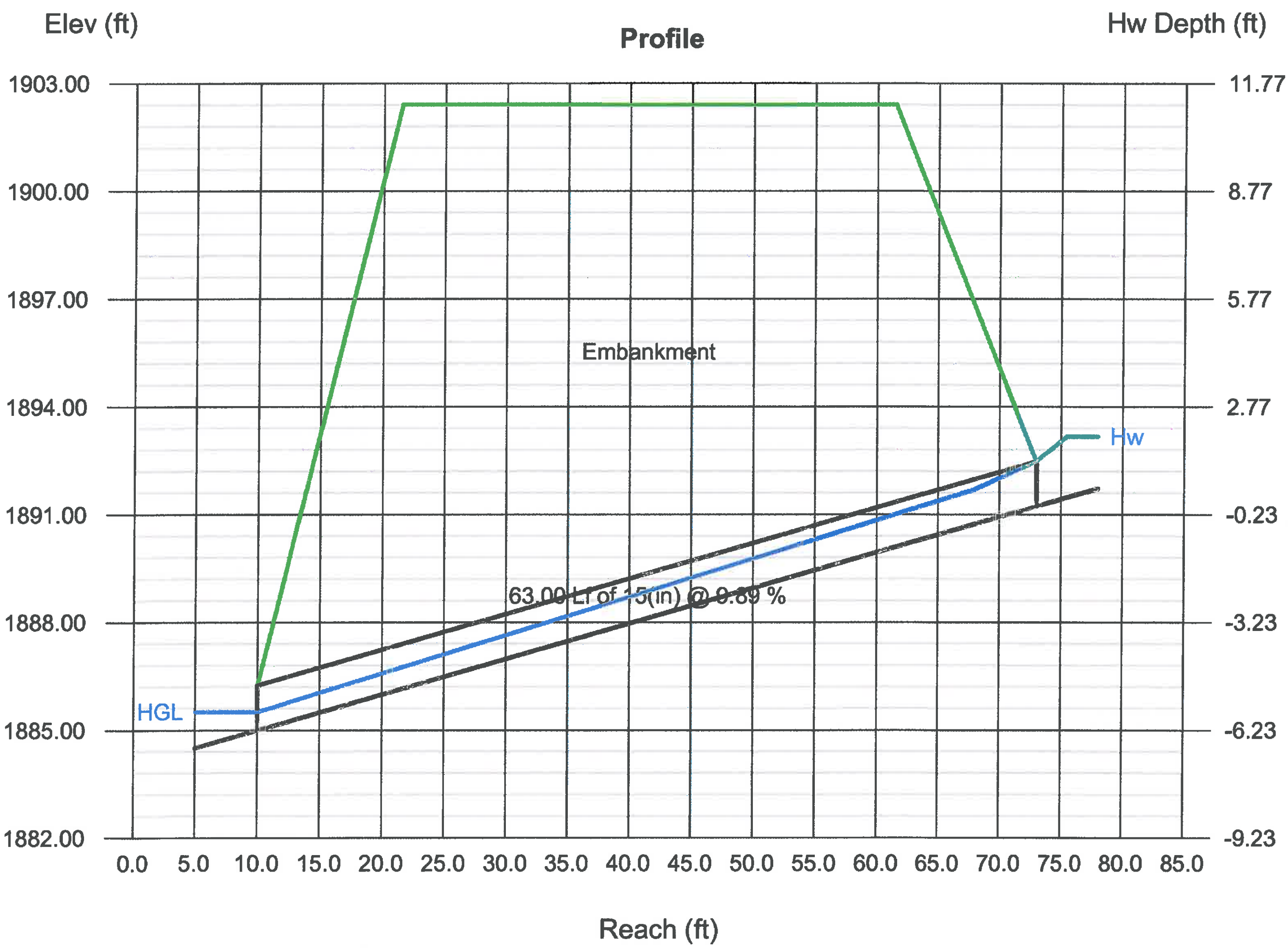
Top Elevation (ft)	=	1902.40
Top Width (ft)	=	40.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	6.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	6.00
Qpipe (cfs)	=	6.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	12.87
Veloc Up (ft/s)	=	5.76
HGL Dn (ft)	=	1885.51
HGL Up (ft)	=	1892.22
Hw Elev (ft)	=	1893.17
Hw/D (ft)	=	1.55
Flow Regime	=	Inlet Control



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	CJH
Checked By:	AJC
Date:	11/1/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-15.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 8.96	D= 1.25	Tw= 0.61	N

1) Apron Width at Outlet

Use Eq 3 4 Feet

2) Apron Length

Use Eq 1 20 Feet

3) Downstream Apron Width

Use Eq 4 24 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

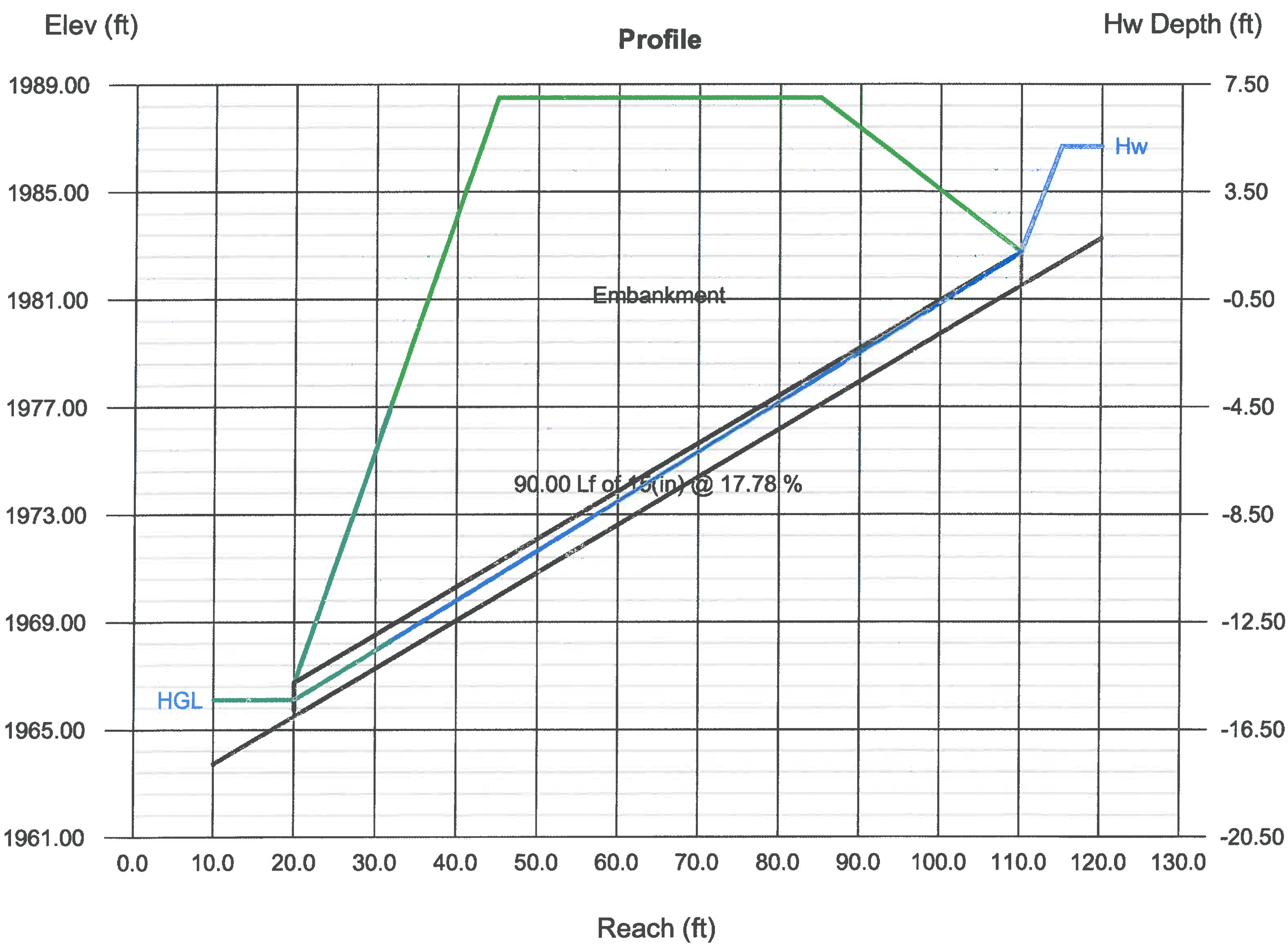
0.49 Feet

Use Erosion Stone

Culvert Report

CEC-15.0

Invert Elev Dn (ft)	= 1965.50	**Calculations**	
Pipe Length (ft)	= 90.00	Qmin (cfs)	= 0.72
Slope (%)	= 17.78	Qmax (cfs)	= 11.22
Invert Elev Up (ft)	= 1981.50	Tailwater Elev (ft)	= Critical
Rise (in)	= 15.0		
Shape	= Circular	**Highlighted**	
Span (in)	= 15.0	Qtotal (cfs)	= 11.22
No. Barrels	= 1	Qpipe (cfs)	= 11.22
n-Value	= 0.015	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Corrugate Metal Pipe	Veloc Dn (ft/s)	= 18.91
Culvert Entrance	= Projecting	Veloc Up (ft/s)	= 9.24
Coeff. K,M,c,Y,k	= 0.034, 1.5, 0.0553, 0.54, 0.9	HGL Dn (ft)	= 1966.11
		HGL Up (ft)	= 1982.71
Embankment		Hw Elev (ft)	= 1986.69
Top Elevation (ft)	= 1988.50	Hw/D (ft)	= 4.15
Top Width (ft)	= 40.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 100.00		



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-GCA-1.1 Outlet Protection

Data:	CFS	Feet	Feet	Channel (Y or N)
	Q= 11.8	D= 1.5	Tw= 1.31	N

1) Apron Width at Outlet
Use Eq 3 5 Feet

2) Apron Length
Use Eq 2 30 Feet

3) Downstream Apron Width
Use Eq 5 16 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.27 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Nov 6 2013

GCA-1.1

* Invert Elev Dn (ft)	=	2206.00
Pipe Length (ft)	=	56.00
Slope (%)	=	0.89
Invert Elev Up (ft)	=	2206.50
Rise (in)	=	18.0
Shape	=	Cir
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2210.50
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

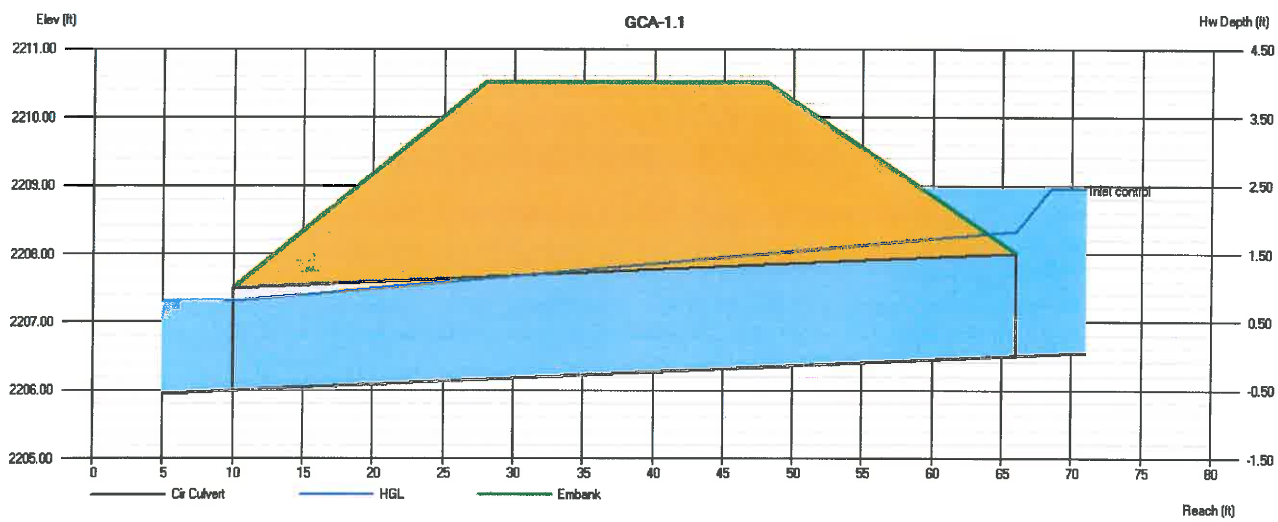
Calculations

Qmin (cfs)	=	11.00
Qmax (cfs)	=	12.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	11.80
Qpipe (cfs)	=	11.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.22
Veloc Up (ft/s)	=	6.68
* HGL Dn (ft)	=	2207.31
HGL Up (ft)	=	2208.32
Hw Elev (ft)	=	2208.94
Hw/D (ft)	=	1.63
Flow Regime	=	Inlet Control

2207.31 − 2206.00 = 1.31



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-2.3 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 10.6	D= 1.5	Tw= 0.49	n

1) Apron Width at Outlet
Use Eq 3 5 Feet

2) Apron Length
Use Eq 1 21 Feet

3) Downstream Apron Width
Use Eq 4 25 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.63 Feet

Use Erosion Stone

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Culvert Report

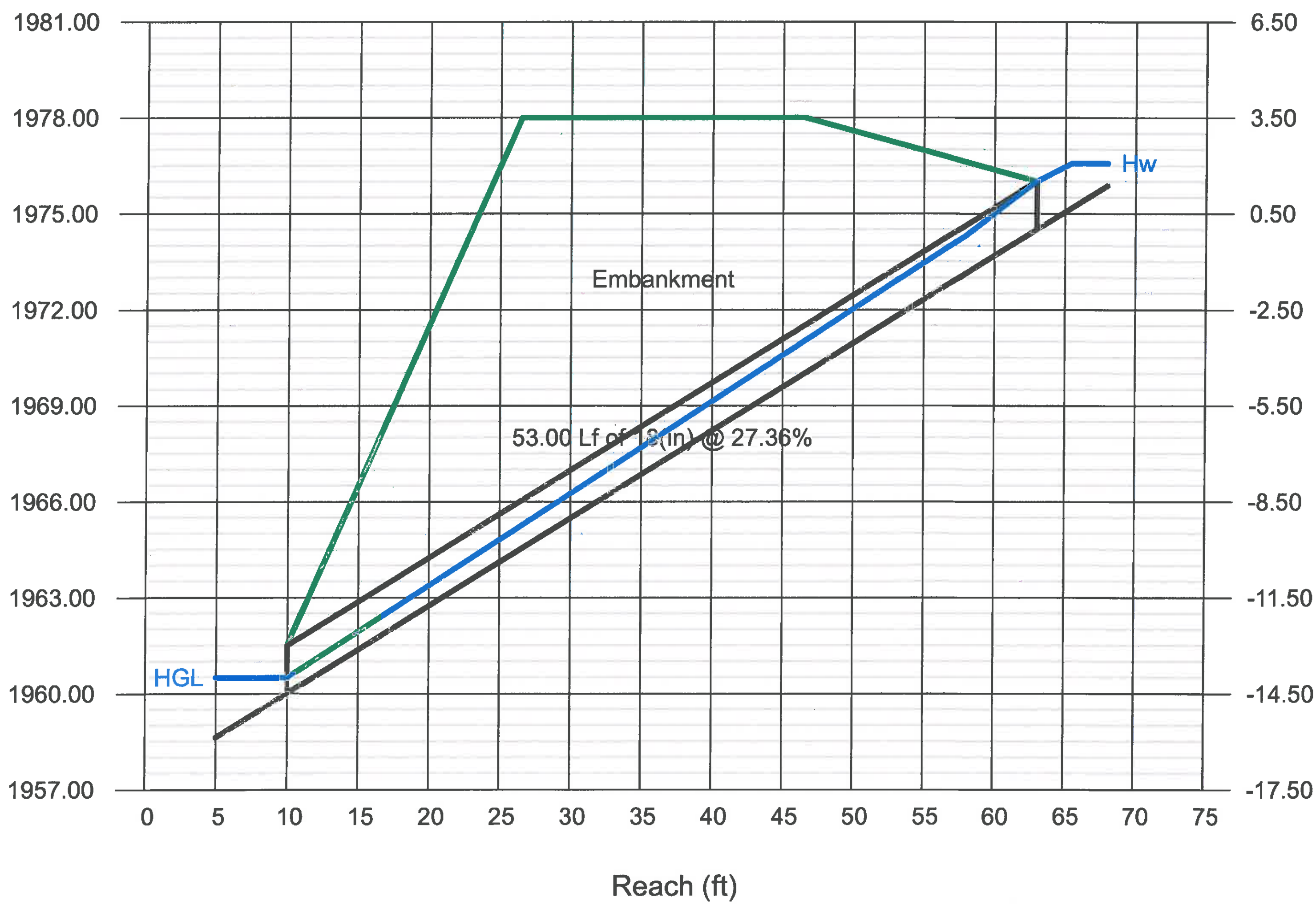
Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Nov 6 2013

CEC-2.3

* Invert Elev Dn (ft)	= 1960.00		**Calculations**		
Pipe Length (ft)	= 53.00		Qmin (cfs)	= 10.00	
Slope (%)	= 27.36		Qmax (cfs)	= 11.00	
Invert Elev Up (ft)	= 1974.50		Tailwater Elev (ft)	= Critical	
Rise (in)	= 18.0				
Shape	= Cir		**Highlighted**		
Span (in)	= 18.0		Qtotal (cfs)	= 10.60	
No. Barrels	= 1		Qpipe (cfs)	= 10.60	
n-Value	= 0.015		Qovertop (cfs)	= 0.00	
Inlet Edge	= Projecting		Veloc Dn (ft/s)	= 21.00	
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.5		Veloc Up (ft/s)	= 6.72	
			HGL Dn (ft)	= 1960.49 *	
Embankment			HGL Up (ft)	= 1975.75	
Top Elevation (ft)	= 1978.00		Hw Elev (ft)	= 1976.56	
Top Width (ft)	= 20.00		Hw/D (ft)	= 1.37	
Crest Width (ft)	= 20.00		Flow Regime	= Inlet Control	

1960.49 - 1960.00 = 0.49

Profile



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

<u>Apron Length</u>

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \dfrac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \dfrac{3 \times Q}{D^{3/2}} + 7 \times D$

<u>Apron Width at Outlet</u> = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
<u>Downstream Apron Width</u> when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-4.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 6	D= 1.25	Tw= 0.67	n

1) Apron Width at Outlet
Use Eq 3 4 Feet

2) Apron Length
Use Eq 2 22 Feet

3) Downstream Apron Width
Use Eq 5 12 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.26 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. | Tuesday, Oct 22 2013

ECA-4.0

Invert Elev Dn (ft)	=	2107.00
Pipe Length (ft)	=	68.00
Slope (%)	=	3.68
Invert Elev Up (ft)	=	2109.50
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	=	2114.00
Top Width (ft)	=	40.00
Crest Width (ft)	=	100.00

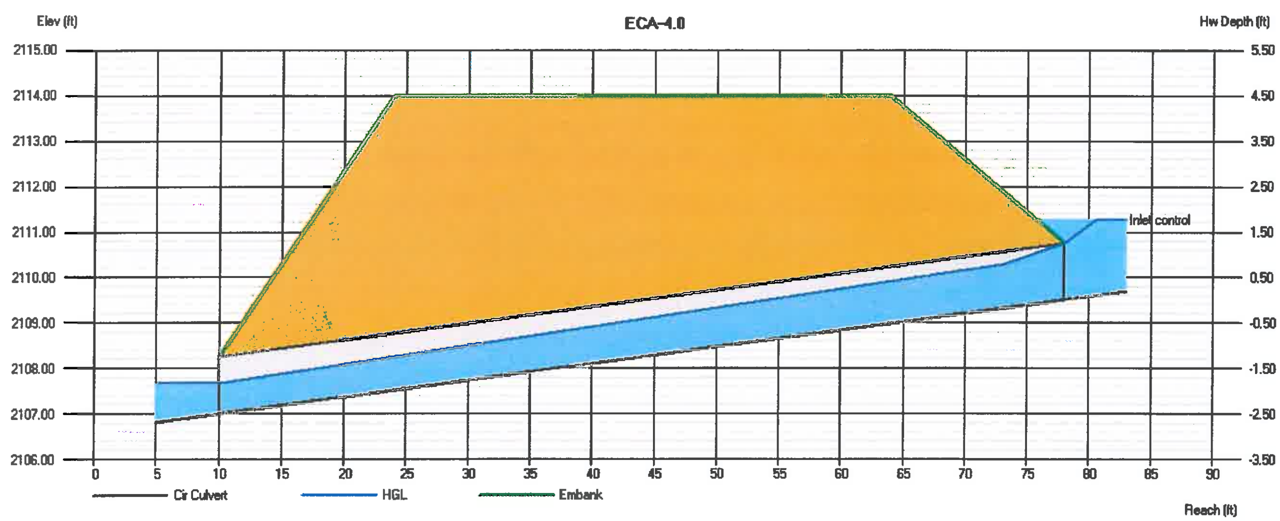
Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	6.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	6.00
Qpipe (cfs)	=	6.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.94
Veloc Up (ft/s)	=	5.74
HGL Dn (ft)	=	2107.67
HGL Up (ft)	=	2110.49
Hw Elev (ft)	=	2111.27
Hw/D (ft)	=	1.41
Flow Regime	=	Inlet Control

2107.00 – 2107.67 = 0.67'



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-6.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 7	D= 1.25	Tw= 0.64	Y

1) Apron Width at Outlet
Use Channel Bottom Width for Feet

2) Apron Length
Use Eq 2 24 Feet

3) Downstream Apron Width
Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.33 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Tuesday, Oct 22 2013

ECA-6.0

Invert Elev Dn (ft)	=	2017.00
Pipe Length (ft)	=	140.00
Slope (%)	=	5.71
Invert Elev Up (ft)	=	2025.00
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	=	2030.00
Top Width (ft)	=	40.00
Crest Width (ft)	=	100.00

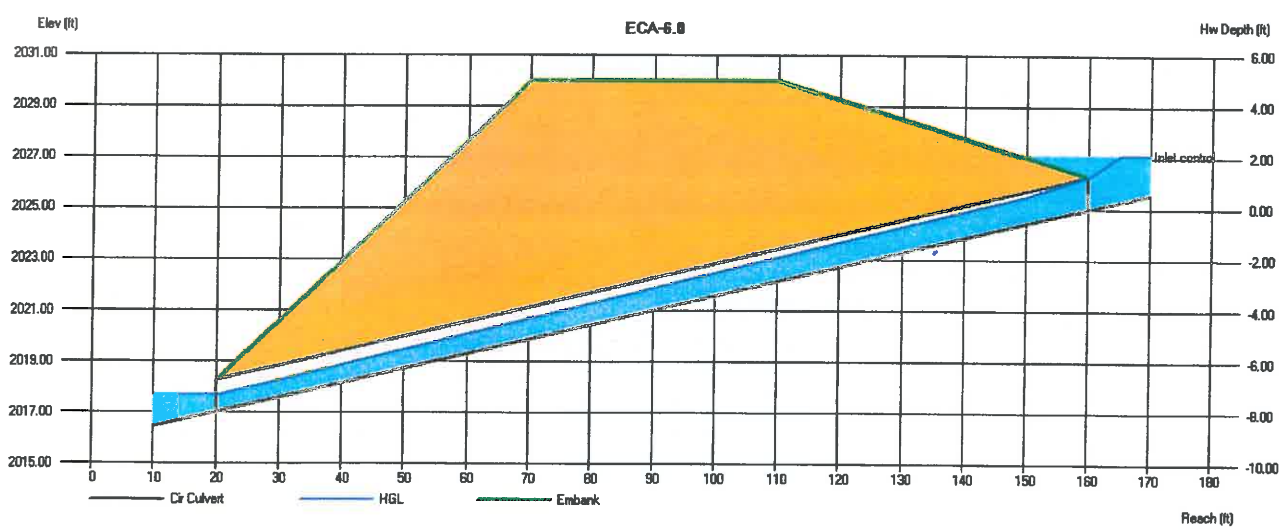
Calculations

Qmin (cfs)	=	6.00
Qmax (cfs)	=	7.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	7.00
Qpipe (cfs)	=	7.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	11.00
Veloc Up (ft/s)	=	6.30
HGL Dn (ft)	=	2017.64
HGL Up (ft)	=	2026.06
Hw Elev (ft)	=	2027.10
Hw/D (ft)	=	1.68
Flow Regime	=	Inlet Control

2017.0 − 2017.64 = 0.64'



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-16.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 2	D= 1.25	Tw= 0.27	n

1) Apron Width at Outlet
   Use Eq 3 — 4 Feet

2) Apron Length
   Use Eq 1 — 11 Feet

3) Downstream Apron Width
   Use Eq 4 — 15 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.15 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Tuesday, Oct 22 2013

CEC-16.0

Invert Elev Dn (ft)	=	1993.00
Pipe Length (ft)	=	94.00
Slope (%)	=	12.77
Invert Elev Up (ft)	=	2005.00
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2008.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

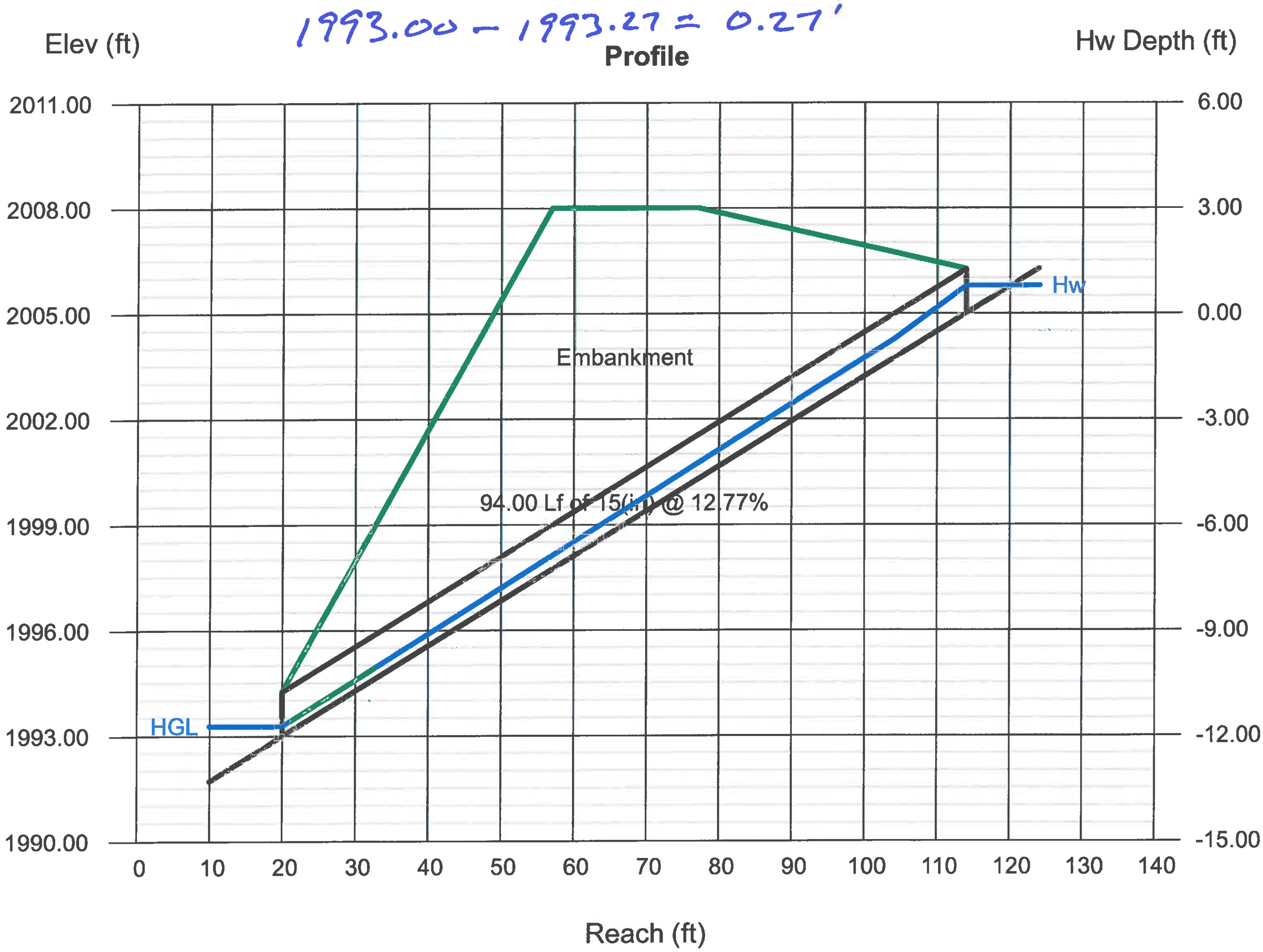
Qmin (cfs)	=	1.00
Qmax (cfs)	=	2.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	2.00
Qpipe (cfs)	=	2.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	10.45
Veloc Up (ft/s)	=	3.71
HGL Dn (ft)	=	1993.27
HGL Up (ft)	=	2005.57
Hw Elev (ft)	=	2005.78
Hw/D (ft)	=	0.62
Flow Regime	=	Inlet Control

1993.00 − 1993.27 = 0.27'

Profile



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-7.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 5	D= 1.25	Tw= 0.53	n

1) Apron Width at Outlet
   Use Eq 3 4 Feet

2) Apron Length
   Use Eq 1 15 Feet

3) Downstream Apron Width
   Use Eq 4 19 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.26 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Wednesday, Oct 23 2013

ECA-7.0

Invert Elev Dn (ft)	= 1963.00
Pipe Length (ft)	= 104.00
Slope (%)	= 5.77
Invert Elev Up (ft)	= 1969.00
Rise (in)	= 15.0
Shape	= Cir
Span (in)	= 15.0
No. Barrels	= 1
n-Value	= 0.015
Inlet Edge	= Projecting
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	= 1972.00
Top Width (ft)	= 20.00
Crest Width (ft)	= 20.00

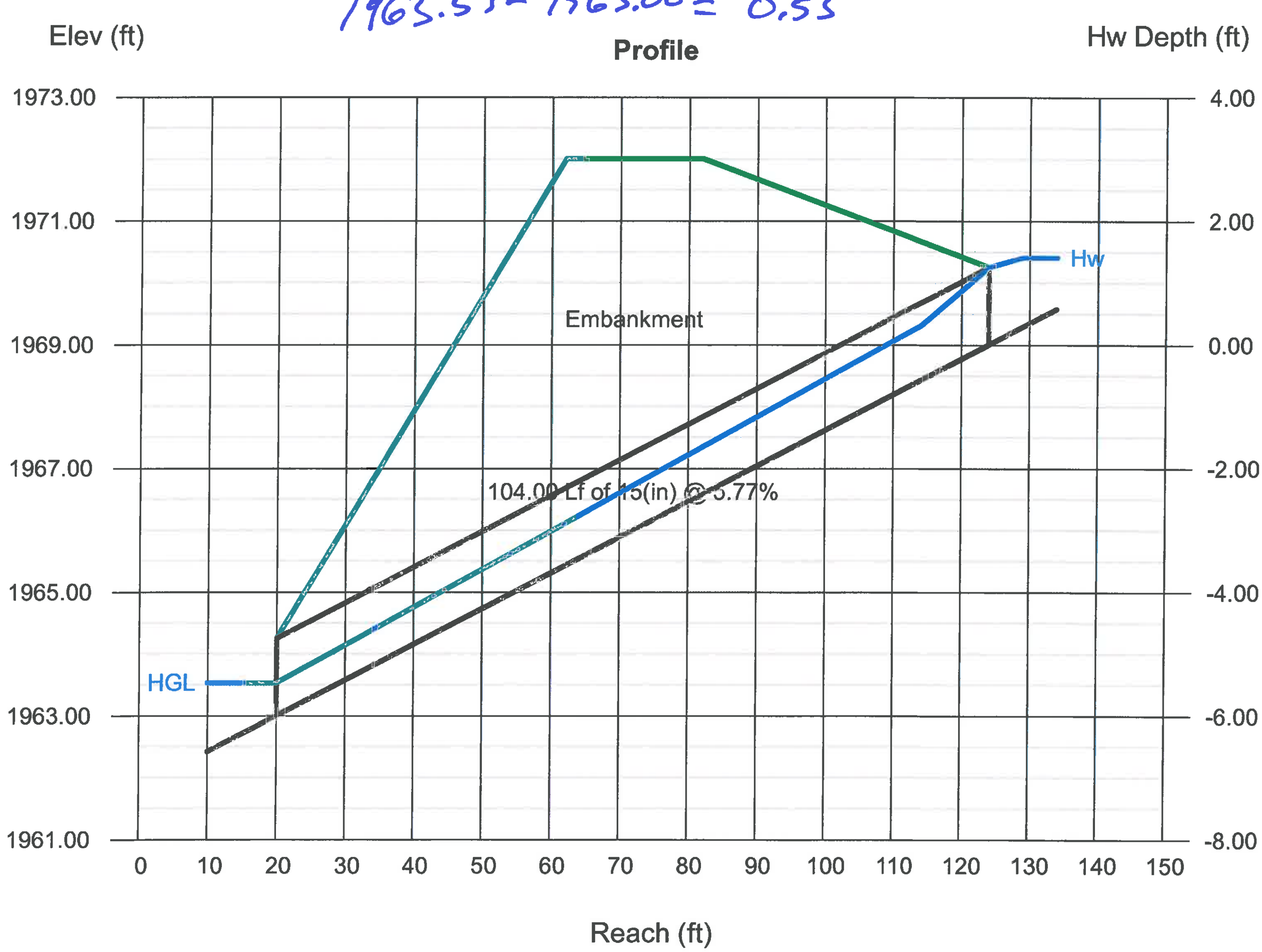
Calculations

Qmin (cfs)	= 4.90
Qmax (cfs)	= 5.20
Tailwater Elev (ft)	= Critical

Highlighted

Qtotal (cfs)	= 5.00
Qpipe (cfs)	= 5.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 10.07
Veloc Up (ft/s)	= 5.22
HGL Dn (ft)	= 1963.53
HGL Up (ft)	= 1969.91
Hw Elev (ft)	= 1970.41
Hw/D (ft)	= 1.13
Flow Regime	= Inlet Control

1963.53 - 1963.00 = 0.53'



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-8.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 13	D= 1.5	Tw= 0.79	n

1) Apron Width at Outlet
   Use Eq 3 — 5 Feet

2) Apron Length
   Use Eq 2 — 32 Feet

3) Downstream Apron Width
   Use Eq 5 — 17 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.52 Feet

Use Erosion Stone

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Wednesday, Oct 23 2013

ECA-8.0

Invert Elev Dn (ft)	=	1870.00
Pipe Length (ft)	=	78.00
Slope (%)	=	7.37
Invert Elev Up (ft)	=	1875.75
Rise (in)	=	18.0
Shape	=	Cir
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1880.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

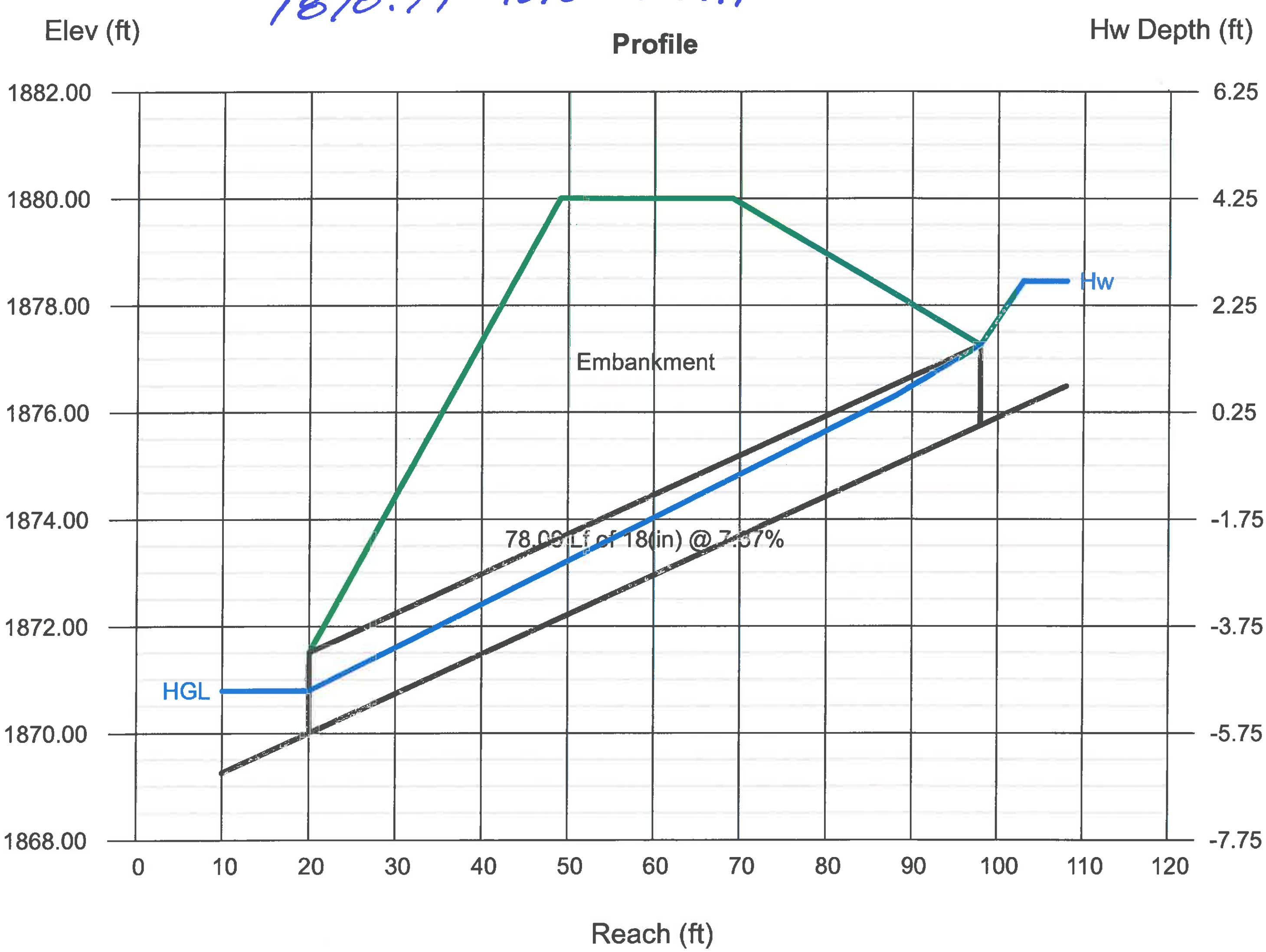
Calculations

Qmin (cfs)	=	12.00
Qmax (cfs)	=	13.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	13.00
Qpipe (cfs)	=	13.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	13.85
Veloc Up (ft/s)	=	7.75
HGL Dn (ft)	=	1870.79
HGL Up (ft)	=	1877.10
Hw Elev (ft)	=	1878.45
Hw/D (ft)	=	1.80
Flow Regime	=	Inlet Control

1870.79 − 1870.00 = 0.79'



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-9.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 2	D= 1.25	Tw= 0.23	y

1) Apron Width at Outlet
   Use Channel Bottom Width for Feet

2) Apron Length
   Use Eq 1 11 Feet

3) Downstream Apron Width
   Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.18 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Oct 23 2013

ECA-9.0

Invert Elev Dn (ft)	=	1845.00
Pipe Length (ft)	=	119.00
Slope (%)	=	22.69
Invert Elev Up (ft)	=	1872.00
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1876.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

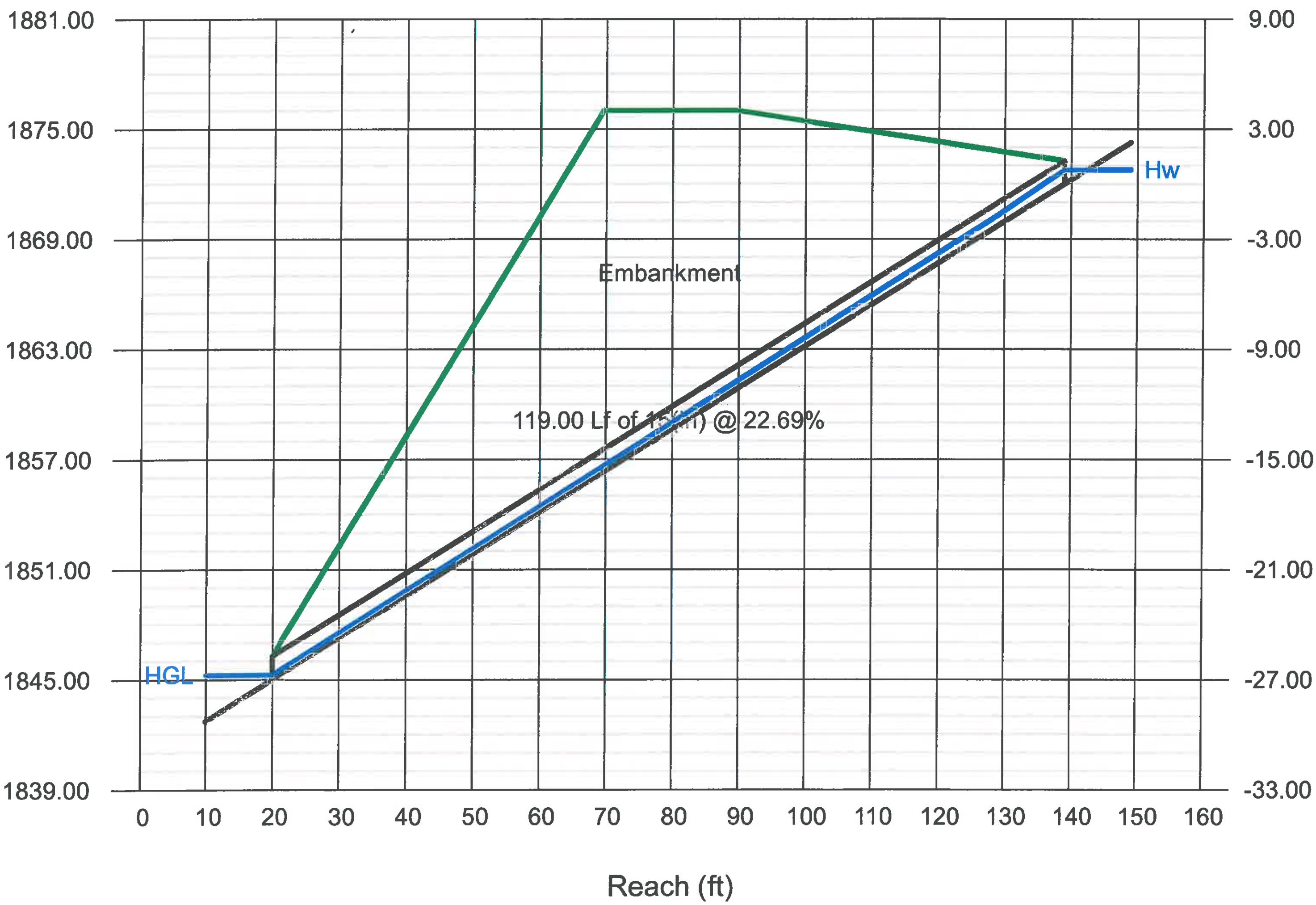
Qmin (cfs)	=	1.00
Qmax (cfs)	=	2.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	2.00
Qpipe (cfs)	=	2.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	12.77
Veloc Up (ft/s)	=	3.71
HGL Dn (ft)	=	1845.23
HGL Up (ft)	=	1872.57
Hw Elev (ft)	=	1872.76
Hw/D (ft)	=	0.61
Flow Regime	=	Inlet Control

1845.23 − 1845.00 = 0.23'

Profile



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-10.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 17	D= 2	Tw= 0.7	Y

1) Apron Width at Outlet

   Use Channel Bottom Width for Feet

2) Apron Length

   Use Eq 1 25 Feet

3) Downstream Apron Width

   Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.62 Feet

Use Erosion Stone

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Tuesday, Oct 22 2013

ECA-10.0

Invert Elev Dn (ft)	=	1845.00
Pipe Length (ft)	=	90.00
Slope (%)	=	11.39
Invert Elev Up (ft)	=	1855.25
Rise (in)	=	24.0
Shape	=	Cir
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1860.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

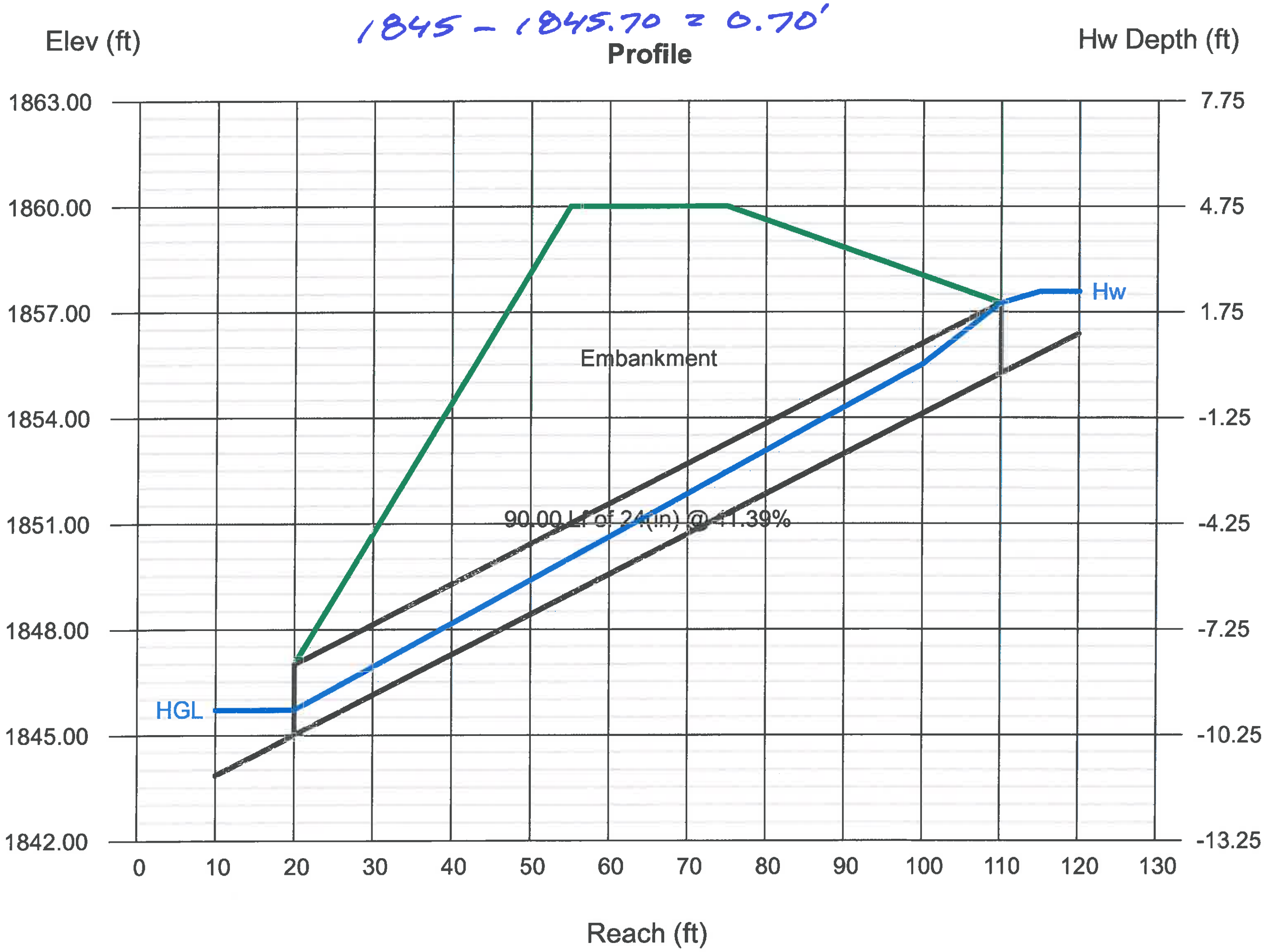
Calculations

Qmin (cfs)	=	16.75
Qmax (cfs)	=	17.25
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	17.00
Qpipe (cfs)	=	17.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	17.38
Veloc Up (ft/s)	=	6.76
HGL Dn (ft)	=	1845.70
HGL Up (ft)	=	1856.74
Hw Elev (ft)	=	1857.57
Hw/D (ft)	=	1.16
Flow Regime	=	Inlet Control

1845 – 1845.70 = 0.70'



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-11.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 2	D= 1.25	Tw= 0.24	y

1) Apron Width at Outlet
   Use Channel Bottom Width for Feet

2) Apron Length
   Use Eq 1 11 Feet

3) Downstream Apron Width
   Use Channel Bottom Width for Feet

4) Stone Size
   $$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.17 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Wednesday, Oct 23 2013

ECA-11.0

Invert Elev Dn (ft)	=	1761.00
Pipe Length (ft)	=	135.00
Slope (%)	=	19.81
Invert Elev Up (ft)	=	1787.74
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1790.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

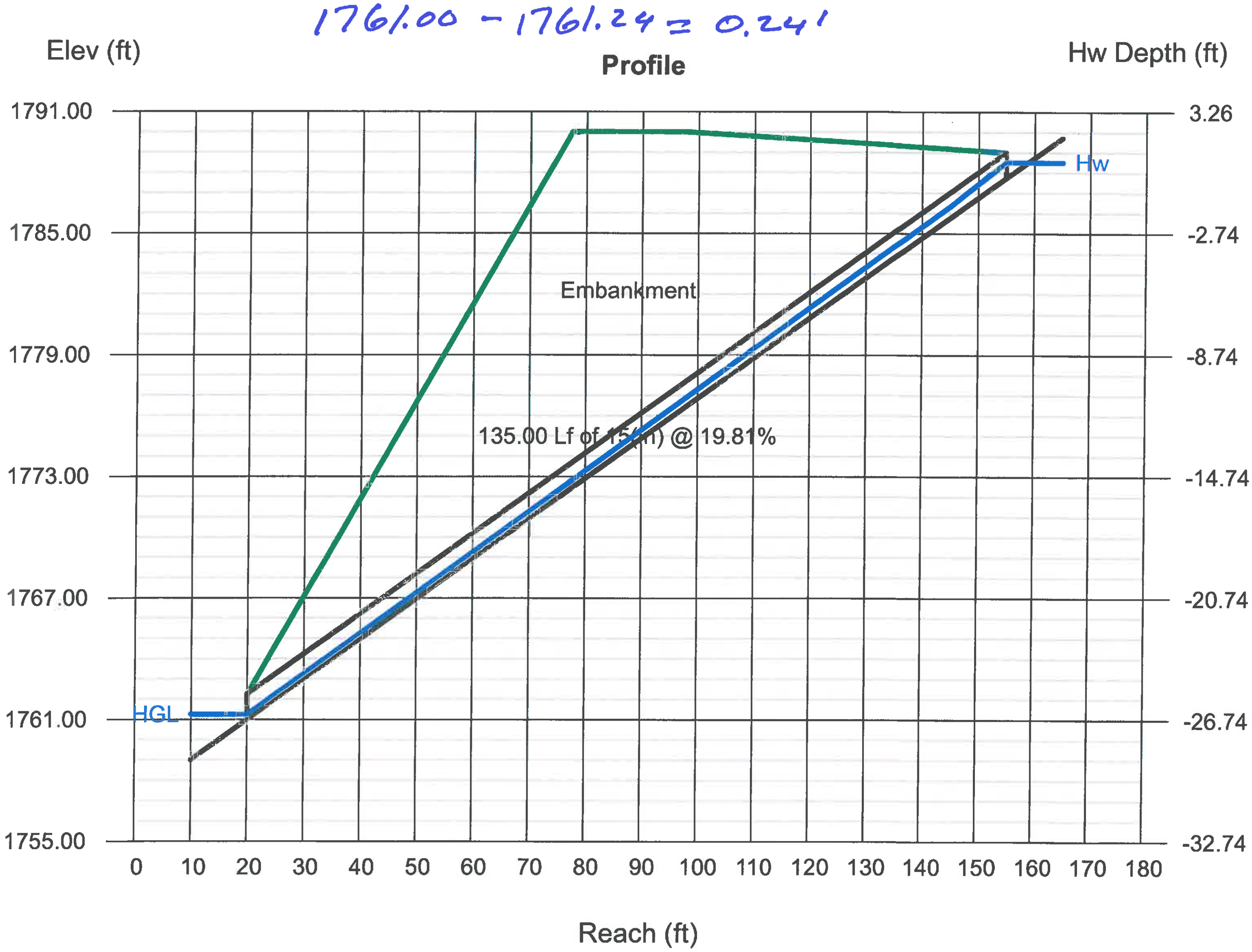
Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	2.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	2.00
Qpipe (cfs)	=	2.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	12.21
Veloc Up (ft/s)	=	3.71
HGL Dn (ft)	=	1761.24
HGL Up (ft)	=	1788.31
Hw Elev (ft)	=	1788.51
Hw/D (ft)	=	0.61
Flow Regime	=	Inlet Control

1761.00 − 1761.24 = 0.24'



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-12.0 Outlet Protection

Data:	CFS	Feet	Feet	Channel (Y or N)
	Q= 19	D= 2	Tw= 0.62	y

1) Apron Width at Outlet

   Use Channel Bottom Width for Feet

2) Apron Length

   Use Eq 1 26 Feet

3) Downstream Apron Width

   Use Channel Bottom Width for Feet

4) Stone Size

   $d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$

   0.82 Feet

Use NHDOT Class B Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Oct 23 2013

ECA-12.0

Invert Elev Dn (ft)	=	1757.00
Pipe Length (ft)	=	106.00
Slope (%)	=	21.93
Invert Elev Up (ft)	=	1780.25
Rise (in)	=	24.0
Shape	=	Cir
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1784.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

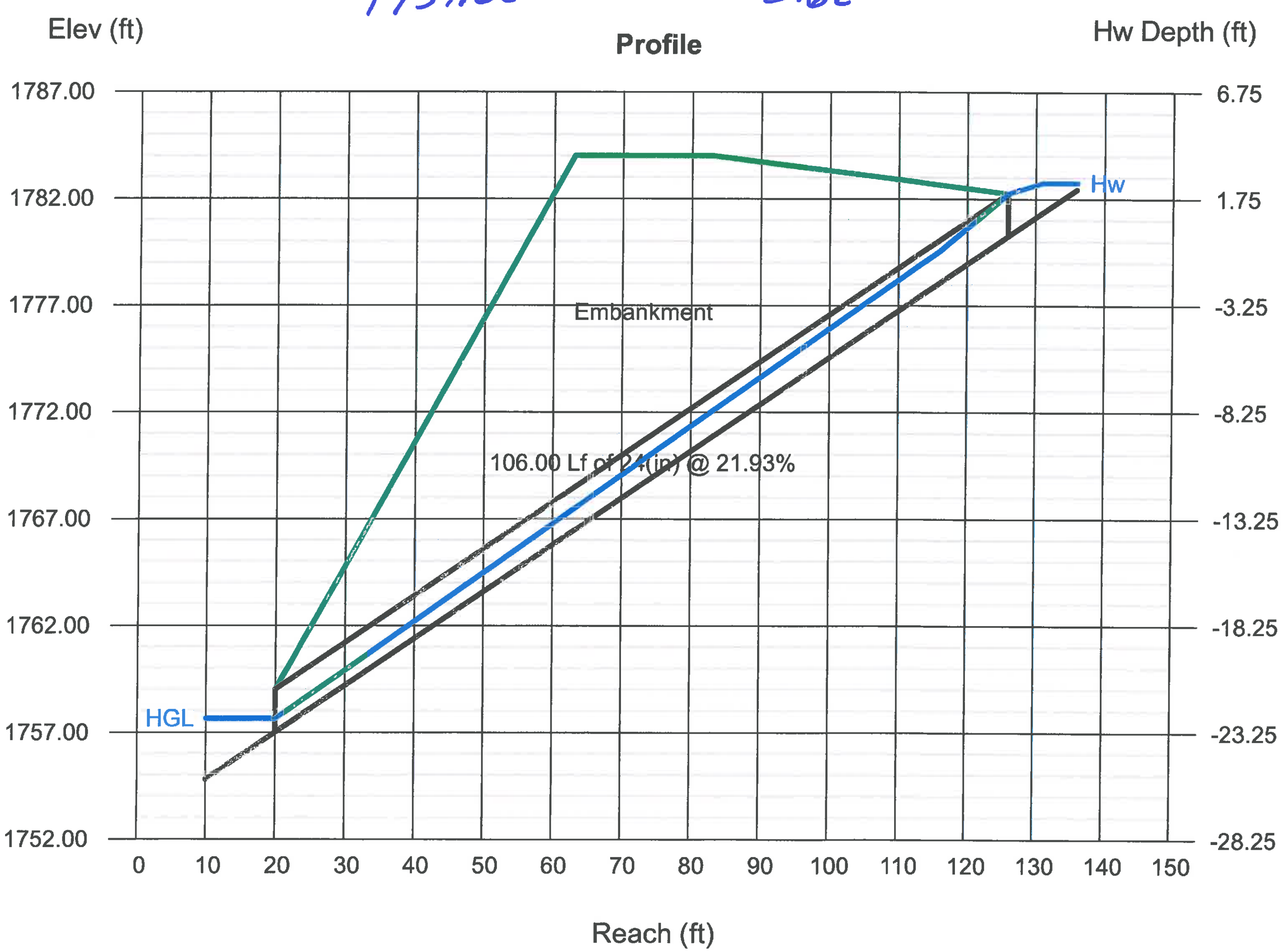
Calculations

Qmin (cfs)	=	18.00
Qmax (cfs)	=	19.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	19.00
Qpipe (cfs)	=	19.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	22.72
Veloc Up (ft/s)	=	7.17
HGL Dn (ft)	=	1757.62
HGL Up (ft)	=	1781.82
Hw Elev (ft)	=	1782.74
Hw/D (ft)	=	1.24
Flow Regime	=	Inlet Control

1757.62 - 1757.00 = 0.62'



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-13.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 20	D= 2	Tw= 0.69	y

1) Apron Width at Outlet
   Use Channel Bottom Width for Feet

2) Apron Length
   Use Eq 1 27 Feet

3) Downstream Apron Width
   Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.79 Feet

Use NHDOT Class B Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Oct 23 2013

ECA-13.0

Invert Elev Dn (ft)	=	1748.00
Pipe Length (ft)	=	102.00
Slope (%)	=	16.67
Invert Elev Up (ft)	=	1765.00
Rise (in)	=	24.0
Shape	=	Cir
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1770.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

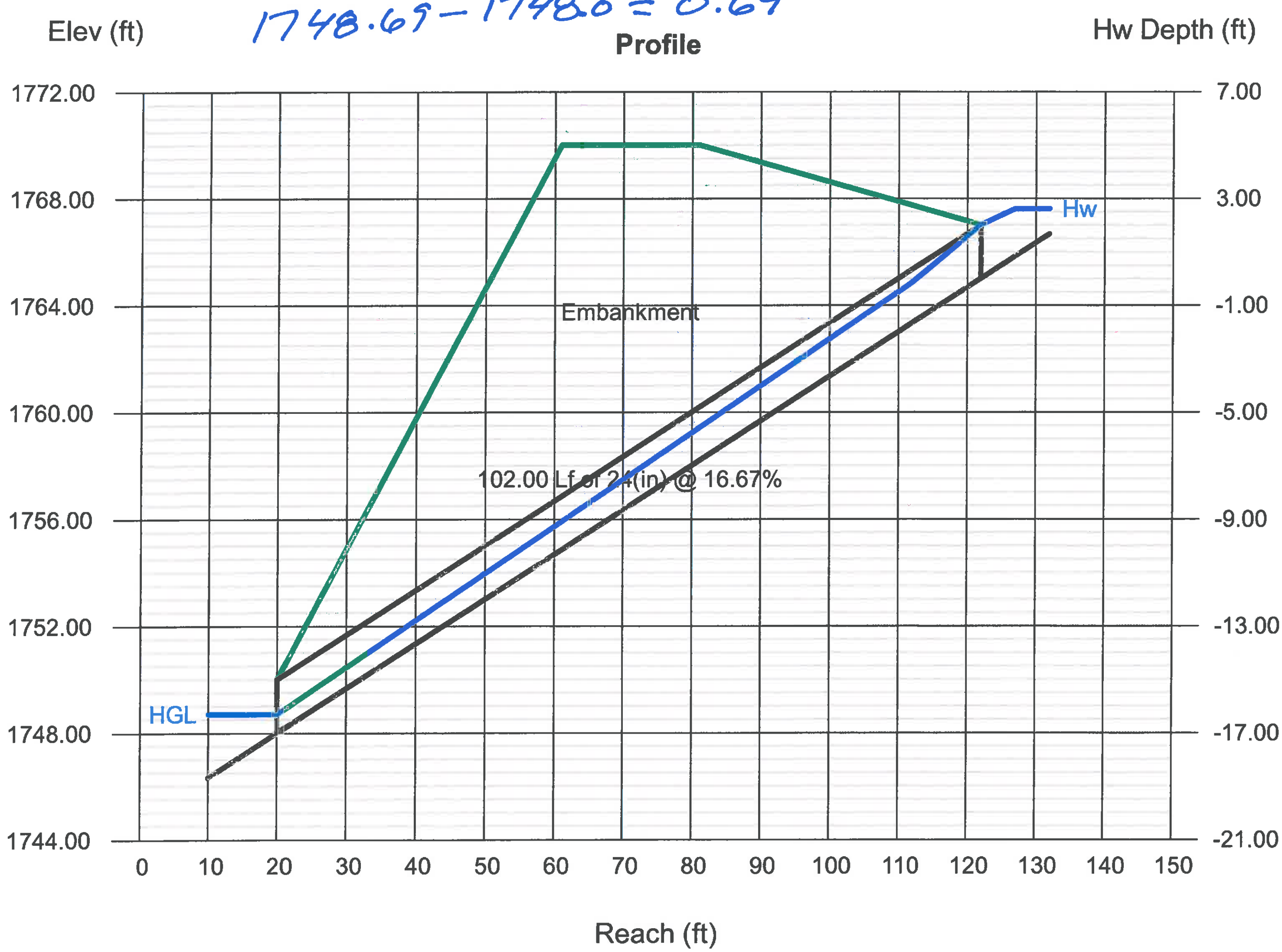
Calculations

Qmin (cfs)	=	19.50
Qmax (cfs)	=	20.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	20.00
Qpipe (cfs)	=	20.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	20.84
Veloc Up (ft/s)	=	7.39
HGL Dn (ft)	=	1748.69
HGL Up (ft)	=	1766.61
Hw Elev (ft)	=	1767.61
Hw/D (ft)	=	1.31
Flow Regime	=	Inlet Control

1748.69 − 1748.0 = 0.69'



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-16.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 7	D= 1.25	Tw= 0.5	y

1) Apron Width at Outlet
   Use Channel Bottom Width for Feet

2) Apron Length
   Use Eq 1 18 Feet

3) Downstream Apron Width
   Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.43 Feet

Use Erosion Stone

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Oct 23 2013

ECA-16.0

Invert Elev Dn (ft)	=	1652.00
Pipe Length (ft)	=	95.00
Slope (%)	=	13.68
Invert Elev Up (ft)	=	1665.00
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1668.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

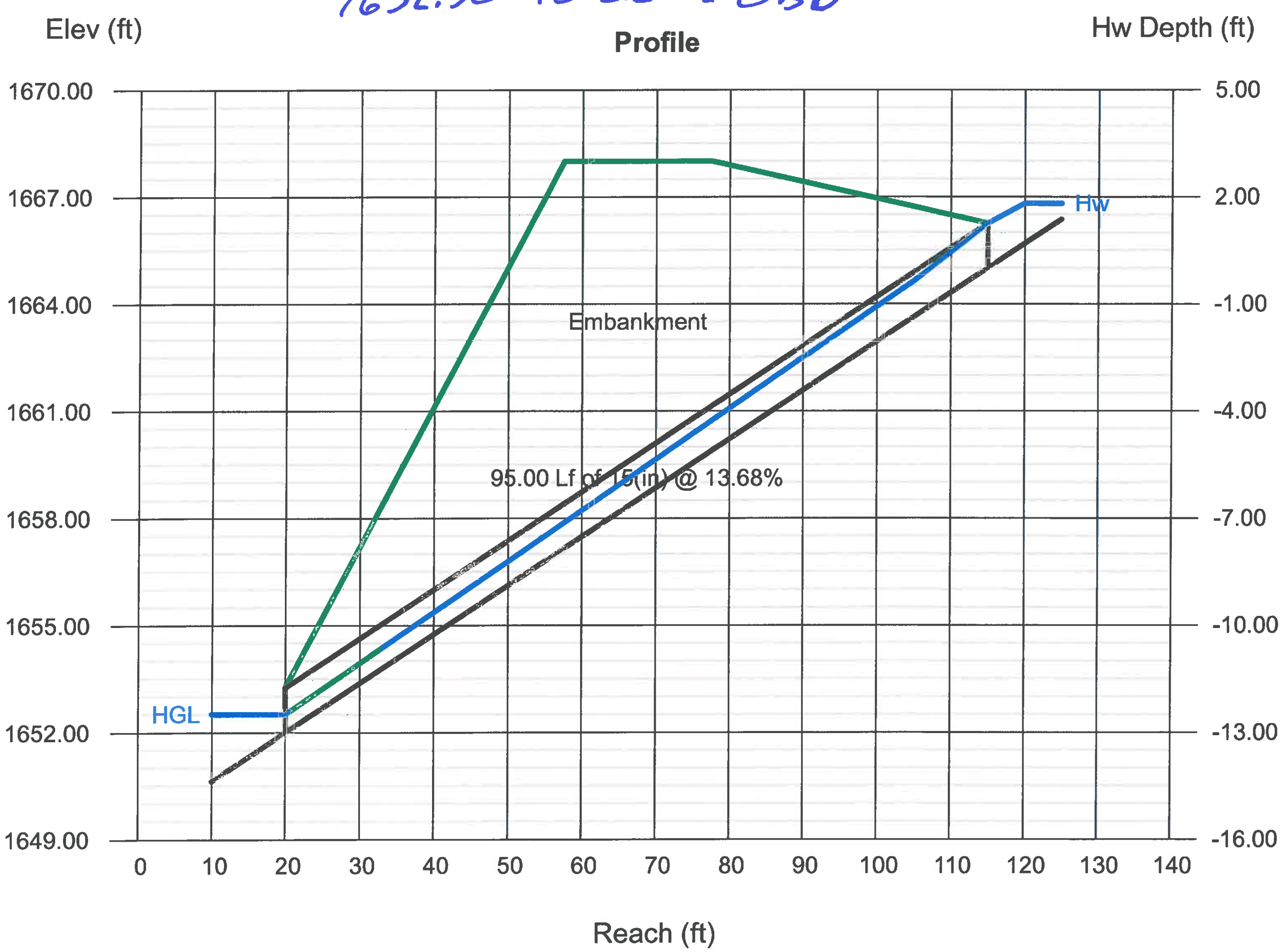
Calculations

Qmin (cfs)	=	6.00
Qmax (cfs)	=	7.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	7.00
Qpipe (cfs)	=	7.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	15.13
Veloc Up (ft/s)	=	6.30
HGL Dn (ft)	=	1652.50
HGL Up (ft)	=	1666.06
Hw Elev (ft)	=	1666.81
Hw/D (ft)	=	1.45
Flow Regime	=	Inlet Control

1652.50 - 1652.00 = 0.50'



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/22/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-ECA-17 & 18 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 2	D= 1	Tw= 0.49	n

1) Apron Width at Outlet
   Use Eq 3 — 3 Feet

2) Apron Length
   Use Eq 1 — 11 Feet

3) Downstream Apron Width
   Use Eq 4 — 14 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.10 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Friday, Nov 8 2013

CV-ECA-17 and 18

Invert Elev Dn (ft)	=	1769.00
Pipe Length (ft)	=	55.00
Slope (%)	=	1.82
Invert Elev Up (ft)	=	1770.00
Rise (in)	=	12.0
Shape	=	Cir
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1781.00
Top Width (ft)	=	6.00
Crest Width (ft)	=	20.00

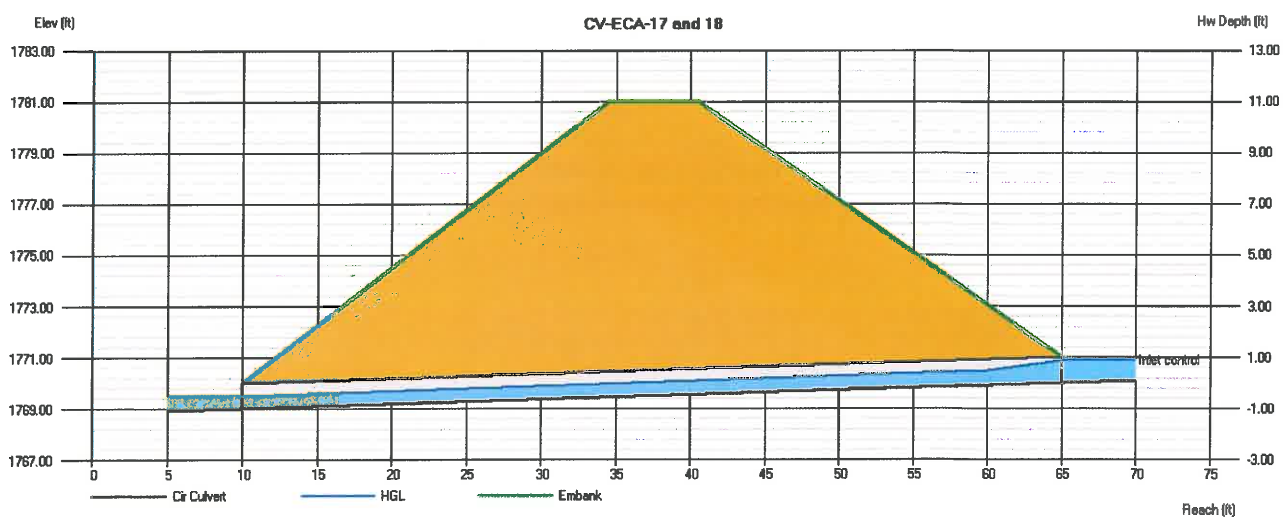
Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	2.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	2.00
Qpipe (cfs)	=	2.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.23
Veloc Up (ft/s)	=	4.01
HGL Dn (ft)	=	1769.49
HGL Up (ft)	=	1770.61
Hw Elev (ft)	=	1770.89
Hw/D (ft)	=	0.89
Flow Regime	=	Inlet Control

1769.49 − 1769.0 = 0.49'



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

<u>Apron Length</u>

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

<u>Apron Width at Outlet</u> = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

<u>Downstream Apron Width</u> when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CAS-1.3 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 5.8	D= 1.5	Tw= 0.94	N

1) Apron Width at Outlet

   Use Eq 3 — 5 Feet

2) Apron Length

   Use Eq 2 — 20 Feet

3) Downstream Apron Width

   Use Eq 5 — 12 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.15 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Wednesday, Nov 6 2013

CAS-1.3

Invert Elev Dn (ft)	=	1451.00
Pipe Length (ft)	=	56.00
Slope (%)	=	0.89
Invert Elev Up (ft)	=	1451.50
Rise (in)	=	18.0
Shape	=	Cir
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1454.81
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

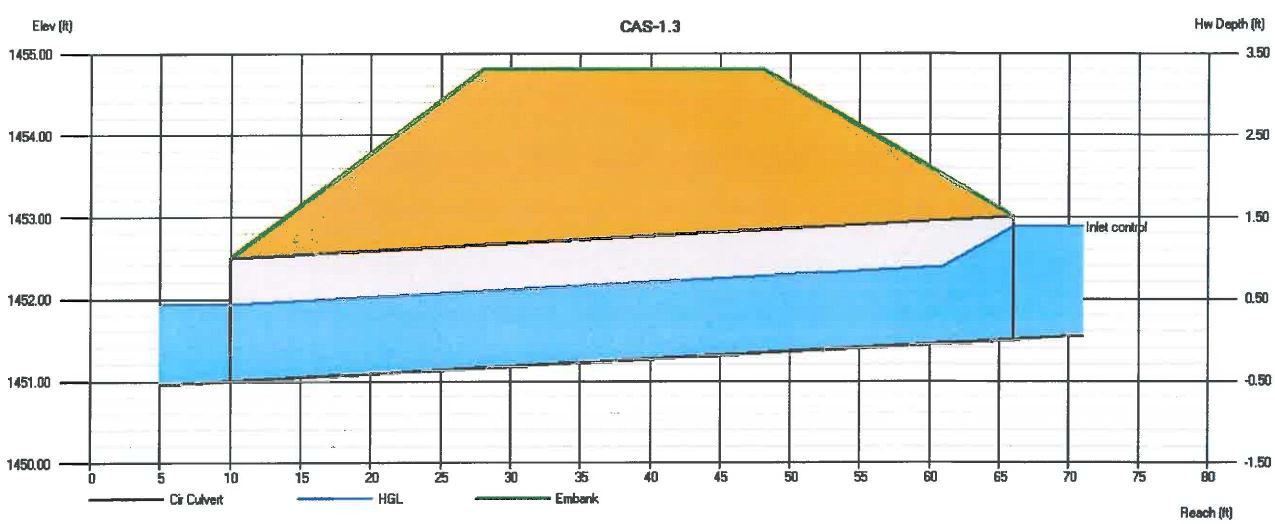
Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	6.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	5.80
Qpipe (cfs)	=	5.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.01
Veloc Up (ft/s)	=	5.01
HGL Dn (ft)	=	1451.94
HGL Up (ft)	=	1452.44
Hw Elev (ft)	=	1452.87
Hw/D (ft)	=	0.92
Flow Regime	=	Inlet Control

1451.94 - 1451.00 = 0.94



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CAS-0.1 Outlet Protection

Data:	CFS	Feet	Feet	Channel (Y or N)
	Q= 4	D= 1.25	Tw= 0.4	N

1) Apron Width at Outlet
Use Eq 3 — 4 Feet

2) Apron Length
Use Eq 1 — 14 Feet

3) Downstream Apron Width
Use Eq 4 — 18 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.25 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Tuesday, Nov 5 2013

CAS-0.1

Invert Elev Dn (ft)	=	1442.40
Pipe Length (ft)	=	86.00
Slope (%)	=	10.70
Invert Elev Up (ft)	=	1451.60
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1455.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

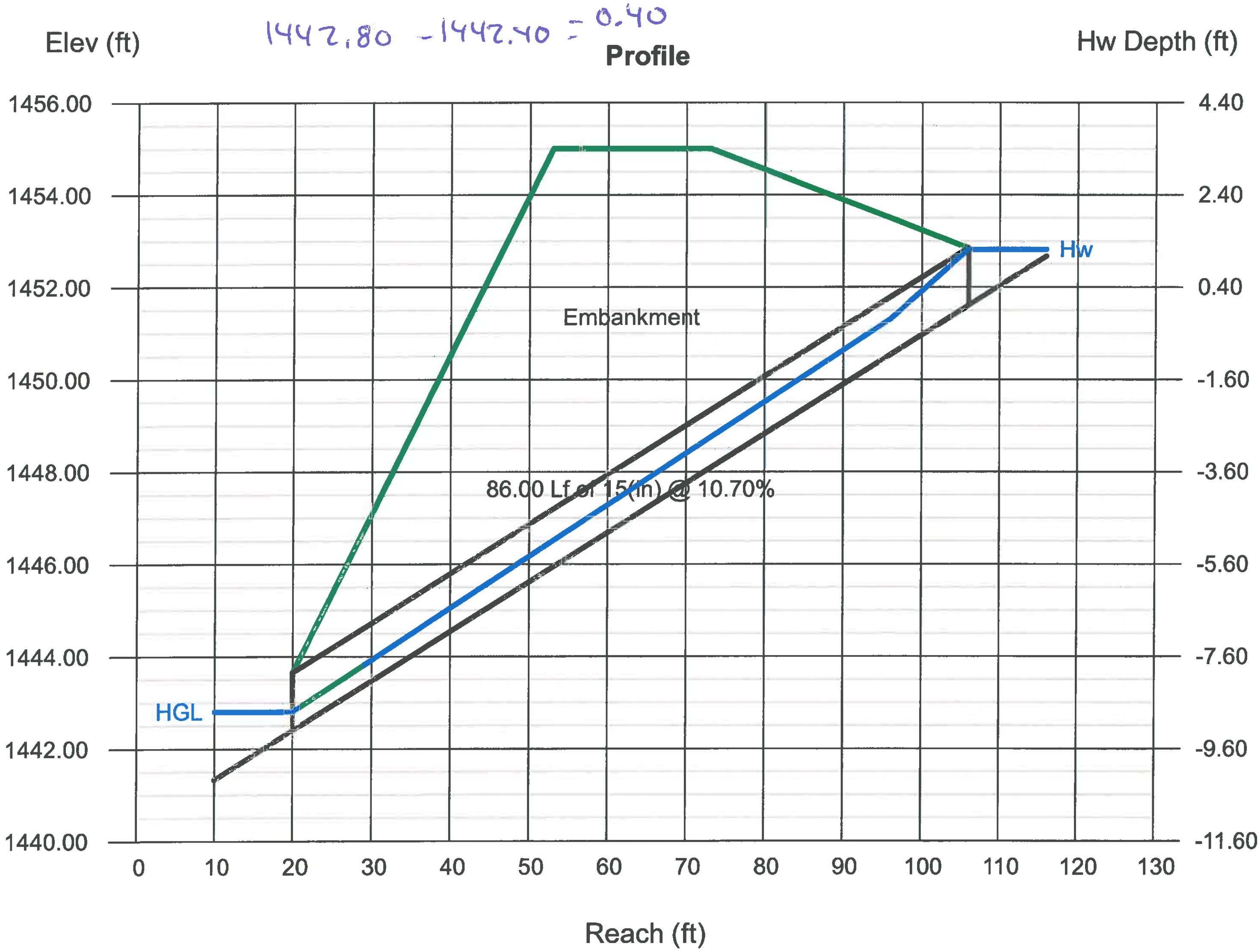
Qmin (cfs)	=	4.00
Qmax (cfs)	=	5.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	4.10
Qpipe (cfs)	=	4.10
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	11.93
Veloc Up (ft/s)	=	4.78
HGL Dn (ft)	=	1442.80
HGL Up (ft)	=	1452.42
Hw Elev (ft)	=	1452.82
Hw/D (ft)	=	0.98
Flow Regime	=	Inlet Control

1442.80 - 1442.40 = 0.40

Profile



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CAC-1.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 26.1	D= 2	Tw= 1.79	N

1) Apron Width at Outlet
   Use Eq 3 — 6 Feet

2) Apron Length
   Use Eq 2 — 42 Feet

3) Downstream Apron Width
   Use Eq 5 — 23 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.43 Feet

Use Erosion Stone

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Tuesday, Nov 5 2013

CAC-1.0

Invert Elev Dn (ft)	=	1365.80
Pipe Length (ft)	=	52.00
Slope (%)	=	0.38
Invert Elev Up (ft)	=	1366.00
Rise (in)	=	24.0
Shape	=	Cir
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1372.70
Top Width (ft)	=	16.00
Crest Width (ft)	=	20.00

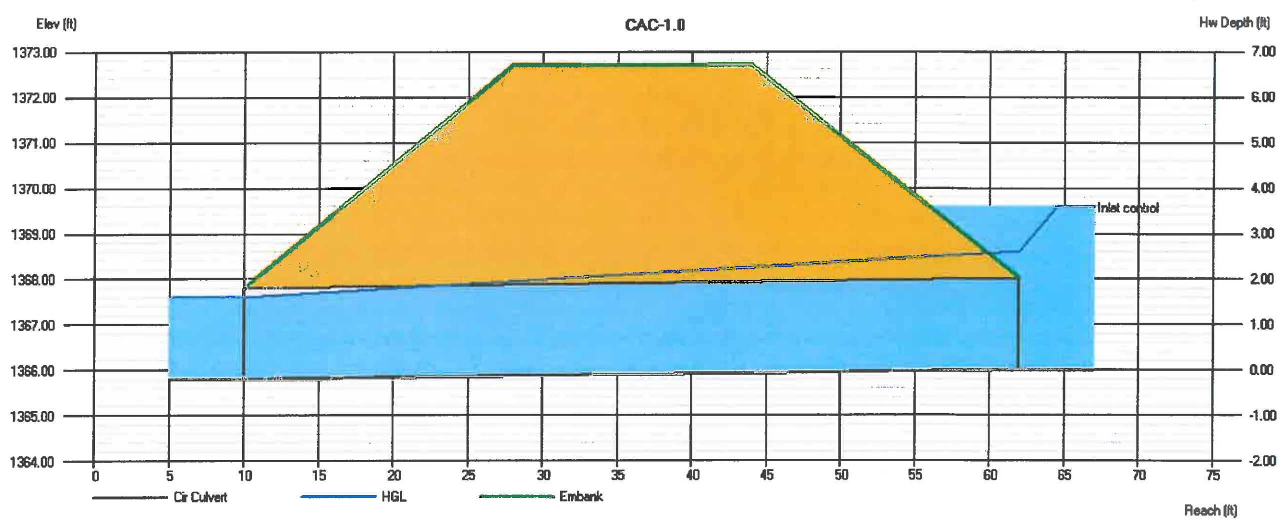
Calculations

Qmin (cfs)	=	26.00
Qmax (cfs)	=	27.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	26.10
Qpipe (cfs)	=	26.10
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.79
Veloc Up (ft/s)	=	8.31
HGL Dn (ft)	=	1367.59
HGL Up (ft)	=	1368.59
Hw Elev (ft)	=	1369.56
Hw/D (ft)	=	1.78
Flow Regime	=	Inlet Control

1367.59 - 1365.80 = 1.79



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-1.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 5.8	D= 1.25	Tw= 0.38	n

1) Apron Width at Outlet

Use Eq 3 4 Feet

2) Apron Length

Use Eq 1 16 Feet

3) Downstream Apron Width

Use Eq 4 20 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.44 Feet

Use Erosion Stone

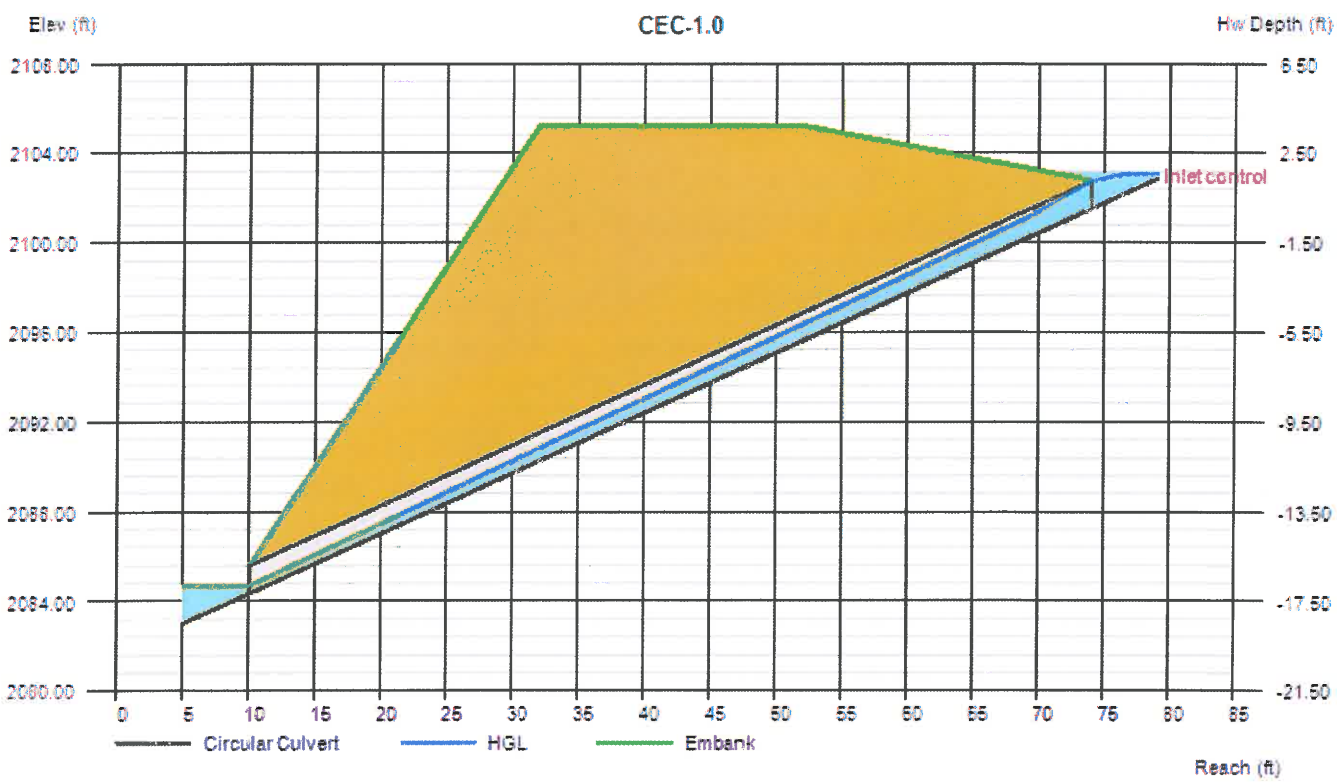
Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. Friday, Nov 22 2013

CEC-1.0

* Invert Elev Dn (ft)	=	2084.34	**Calculations**		
Pipe Length (ft)	=	64.00	Qmin (cfs)	=	5.00
Slope (%)	=	26.81	Qmax (cfs)	=	6.00
Invert Elev Up (ft)	=	2101.50	Tailwater Elev (ft)	=	Critical
Rise (in)	=	15.0			
Shape	=	Circular	**Highlighted**		
Span (in)	=	15.0	Qtotal (cfs)	=	5.80
No. Barrels	=	1	Qpipe (cfs)	=	5.80
n-Value	=	0.015	Qovertop (cfs)	=	0.00
Culvert Type	=	Circular Concrete	Veloc Dn (ft/s)	=	18.31
Culvert Entrance	=	Square edge w/headwall (C)	Veloc Up (ft/s)	=	5.65
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5	* HGL Dn (ft)	=	2084.72
			HGL Up (ft)	=	2102.47
Embankment			Hw Elev (ft)	=	2103.06
Top Elevation (ft)	=	2105.18	Hw/D (ft)	=	1.25
Top Width (ft)	=	20.00	Flow Regime	=	Inlet Control
Crest Width (ft)	=	20.00			

2084.72' − 2084.34' = 0.38' (12) = 4.56"



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**:

$$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**:

$$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-2.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 7.4	D= 1.25	Tw= 0.63	n

1) Apron Width at Outlet
   Use Eq 3 — 4 Feet

2) Apron Length
   Use Eq 2 — 25 Feet

3) Downstream Apron Width
   Use Eq 5 — 14 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.37 Feet

Use Erosion Stone

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Tuesday, Oct 22 2013

CEC-2.0

* Invert Elev Dn (ft)	=	2089.00
Pipe Length (ft)	=	53.00
Slope (%)	=	7.55
Invert Elev Up (ft)	=	2093.00
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2097.30
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

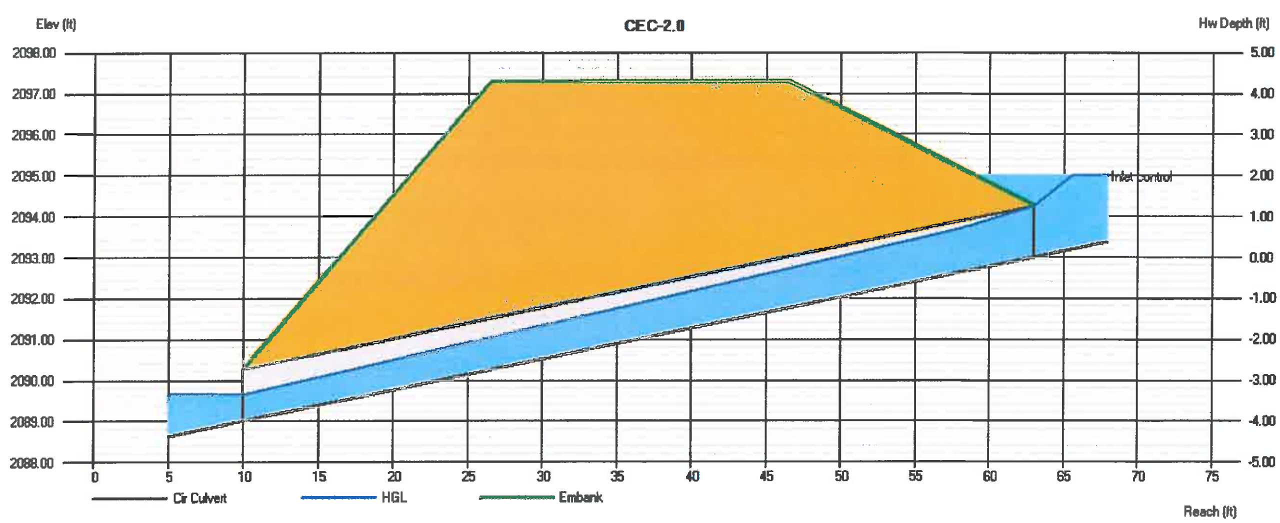
Calculations

Qmin (cfs)	=	7.00
Qmax (cfs)	=	8.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	7.40
Qpipe (cfs)	=	7.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	12.07
Veloc Up (ft/s)	=	6.54
* HGL Dn (ft)	=	2089.63
HGL Up (ft)	=	2094.09
Hw Elev (ft)	=	2094.97
Hw/D (ft)	=	1.57
Flow Regime	=	Inlet Control

2089.63 - 2089.00 = 0.63



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe use **Eq 1**:

$$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe use **Eq 2**:

$$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-4.0 Outlet Protection

Data:	Q= (CFS)	D= (Feet)	Tw= (Feet)	Channel (Y or N)
	2.5	1.25	0.33	n

1) Apron Width at Outlet
   Use Eq 3 — 4 Feet

2) Apron Length
   Use Eq 1 — 12 Feet

3) Downstream Apron Width
   Use Eq 4 — 16 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.16 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Tuesday, Oct 22 2013

CEC-4.0

Invert Elev Dn (ft)	=	1881.00
Pipe Length (ft)	=	42.00
Slope (%)	=	9.52
Invert Elev Up (ft)	=	1885.00
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1888.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

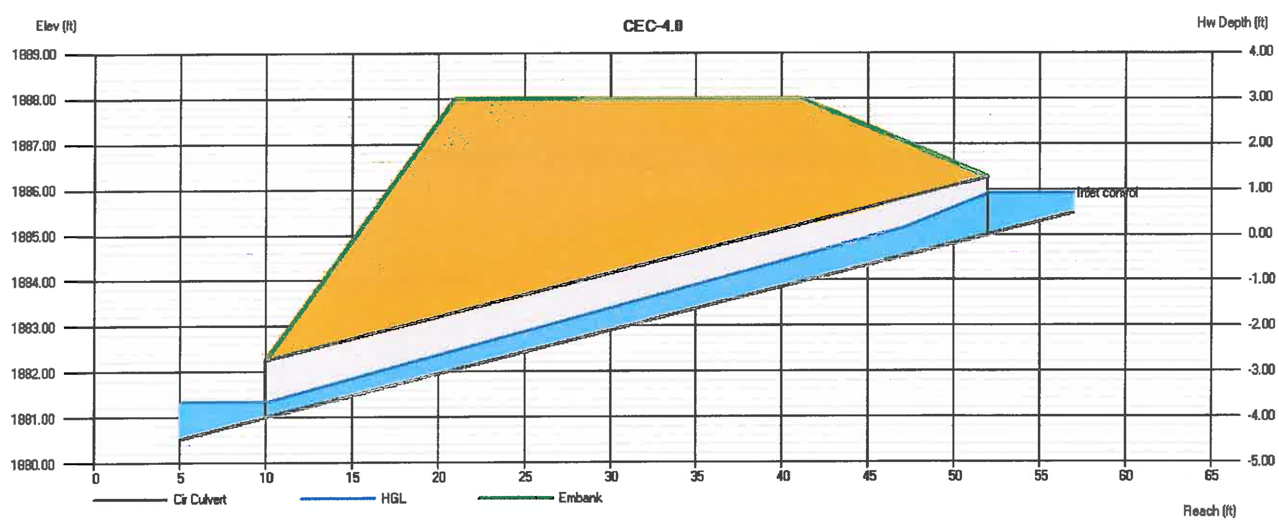
Calculations

Qmin (cfs)	=	2.00
Qmax (cfs)	=	3.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	2.50
Qpipe (cfs)	=	2.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	9.86
Veloc Up (ft/s)	=	3.98
HGL Dn (ft)	=	1881.33
HGL Up (ft)	=	1885.64
Hw Elev (ft)	=	1885.90
Hw/D (ft)	=	0.72
Flow Regime	=	Inlet Control

1881.33 – 1881.00 = 0.33



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-5.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 2.5	D= 1.25	Tw= 0.33	Y

1) Apron Width at Outlet

Use Channel Bottom Width for Feet

2) Apron Length

Use Eq 1 12 Feet

3) Downstream Apron Width

Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.16 Feet

Use NHDOT Class C Stone Fill

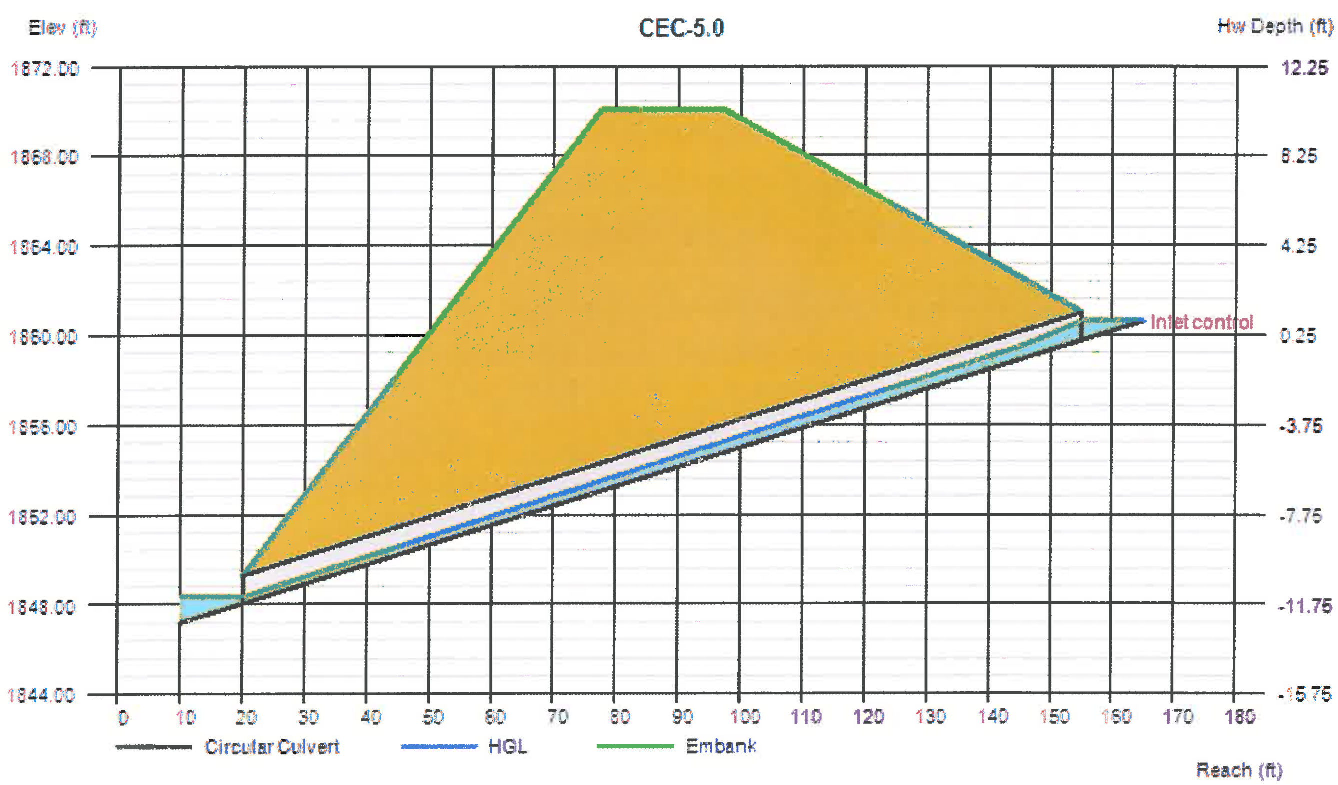
Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. Friday, Nov 22 2013

CEC-5.0

* Invert Elev Dn (ft)	= 1848.04	**Calculations**	
Pipe Length (ft)	= 135.00	Qmin (cfs)	= 2.00
Slope (%)	= 8.67	Qmax (cfs)	= 3.00
Invert Elev Up (ft)	= 1859.75	Tailwater Elev (ft)	= Critical
Rise (in)	= 15.0		
Shape	= Circular	**Highlighted**	
Span (in)	= 15.0	Qtotal (cfs)	= 2.50
No. Barrels	= 1	Qpipe (cfs)	= 2.50
n-Value	= 0.015	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 9.63
Culvert Entrance	= Square edge w/headwall (C)	Veloc Up (ft/s)	= 4.01
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5	* HGL Dn (ft)	= 1848.37
		HGL Up (ft)	= 1860.38
Embankment		Hw Elev (ft)	= 1860.62
Top Elevation (ft)	= 1870.00	Hw/D (ft)	= 0.70
Top Width (ft)	= 20.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 20.00		

1848.37' - 1848.04' = 0.33' (12) = 3.96"



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-7.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 0.7	D= 1.25	Tw= 0.15	n

1) Apron Width at Outlet
   Use Eq 3 — 4 Feet

2) Apron Length
   Use Eq 1 — 10 Feet

3) Downstream Apron Width
   Use Eq 4 — 13 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.07 Feet

Use NHDOT Class C Stone Fill

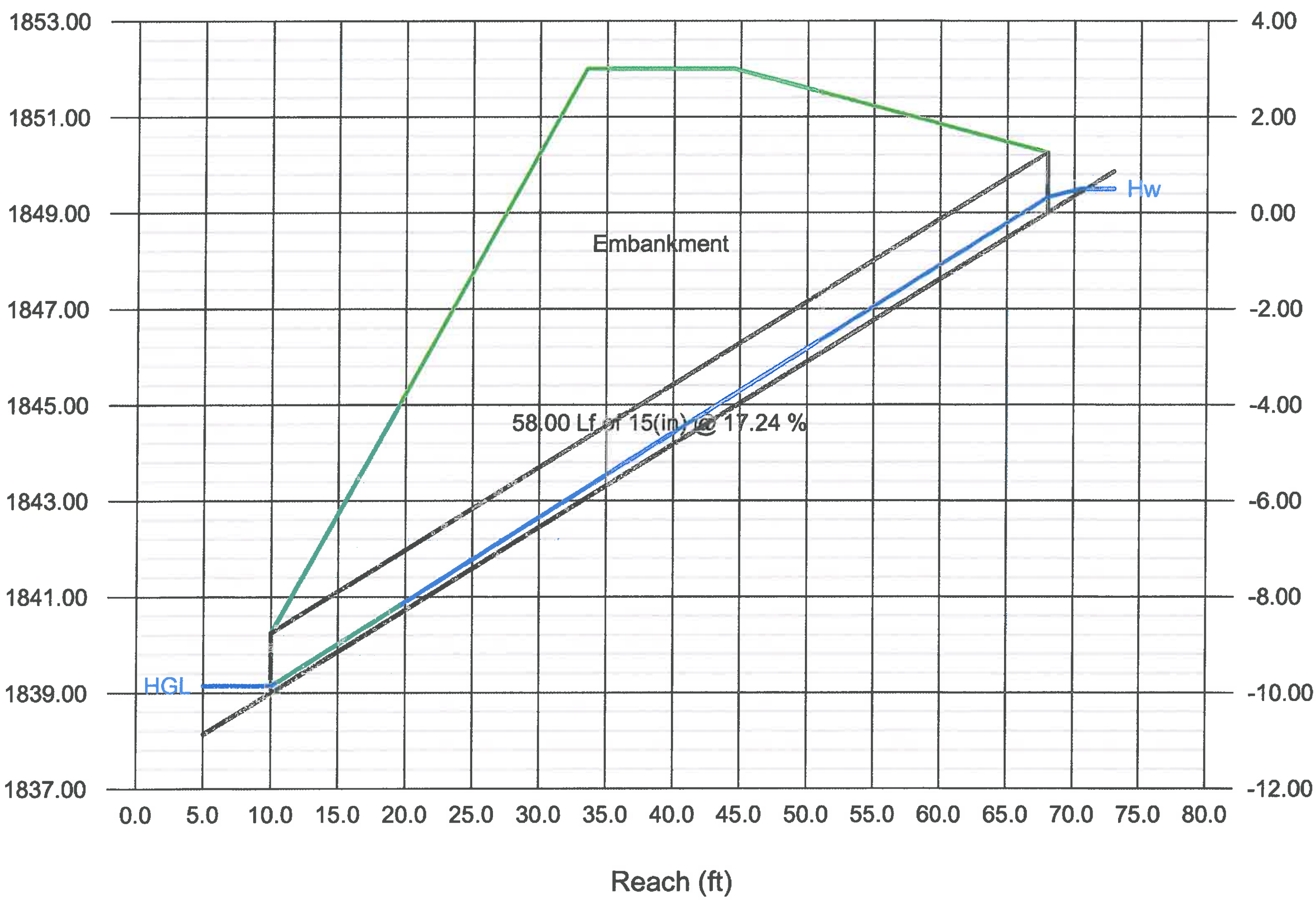
Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. — Friday, Nov 22 2013

CEC-7.0

Invert Elev Dn (ft)	= 1839.00	**Calculations**	
Pipe Length (ft)	= 58.00	Qmin (cfs)	= 0.00
Slope (%)	= 17.24	Qmax (cfs)	= 1.00
Invert Elev Up (ft)	= 1849.00	Tailwater Elev (ft)	= Critical
Rise (in)	= 15.0		
Shape	= Circular	**Highlighted**	
Span (in)	= 15.0	Qtotal (cfs)	= 0.70
No. Barrels	= 1	Qpipe (cfs)	= 0.70
n-Value	= 0.015	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 8.47
Culvert Entrance	= Square edge w/headwall (C)	Veloc Up (ft/s)	= 2.74
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5	HGL Dn (ft)	= 1839.15
		HGL Up (ft)	= 1849.33
Embankment		Hw Elev (ft)	= 1849.50
Top Elevation (ft)	= 1852.00	Hw/D (ft)	= 0.40
Top Width (ft)	= 11.00	Flow Regime	= Outlet Control
Crest Width (ft)	= 20.00		

1839.15' - 1839.00' = 0.15' (12) = 1.8"



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-8.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 5.5	D= 1.25	Tw= 0.95	Y

1) Apron Width at Outlet
Use Channel Bottom Width for Feet

2) Apron Length
Use Eq 2 21 Feet

3) Downstream Apron Width
Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.16 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Wednesday, Oct 23 2013

CEC-8.0

Invert Elev Dn (ft)	=	1801.00
Pipe Length (ft)	=	42.00
Slope (%)	=	1.19
Invert Elev Up (ft)	=	1801.50
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1807.00
Top Width (ft)	=	11.00
Crest Width (ft)	=	20.00

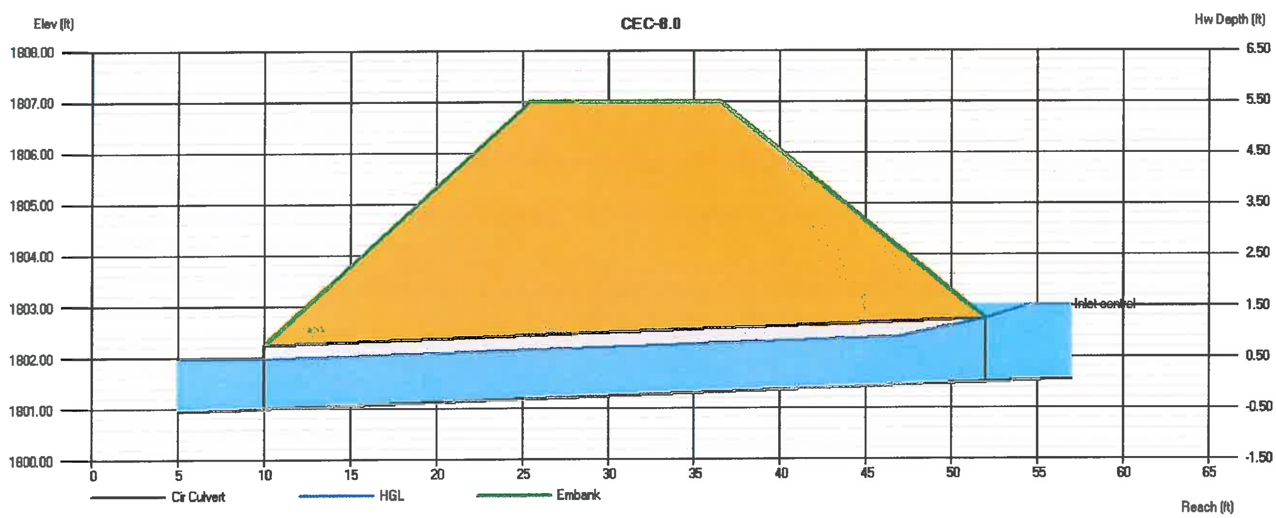
Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	6.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	5.50
Qpipe (cfs)	=	5.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.47
Veloc Up (ft/s)	=	5.46
HGL Dn (ft)	=	1801.95
HGL Up (ft)	=	1802.46
Hw Elev (ft)	=	1803.01
Hw/D (ft)	=	1.21
Flow Regime	=	Inlet Control

1801.95 – 1801.00 = 0.95



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-9.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 1	D= 1.25	Tw= 0.19	N

1) Apron Width at Outlet
   Use Eq 3 — 4 Feet

2) Apron Length
   Use Eq 1 — 10 Feet

3) Downstream Apron Width
   Use Eq 4 — 14 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.08 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc.

Wednesday, Oct 23 2013

CEC-9.0

* Invert Elev Dn (ft)	=	1805.00
Pipe Length (ft)	=	46.00
Slope (%)	=	13.04
Invert Elev Up (ft)	=	1811.00
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1814.30
Top Width (ft)	=	11.00
Crest Width (ft)	=	20.00

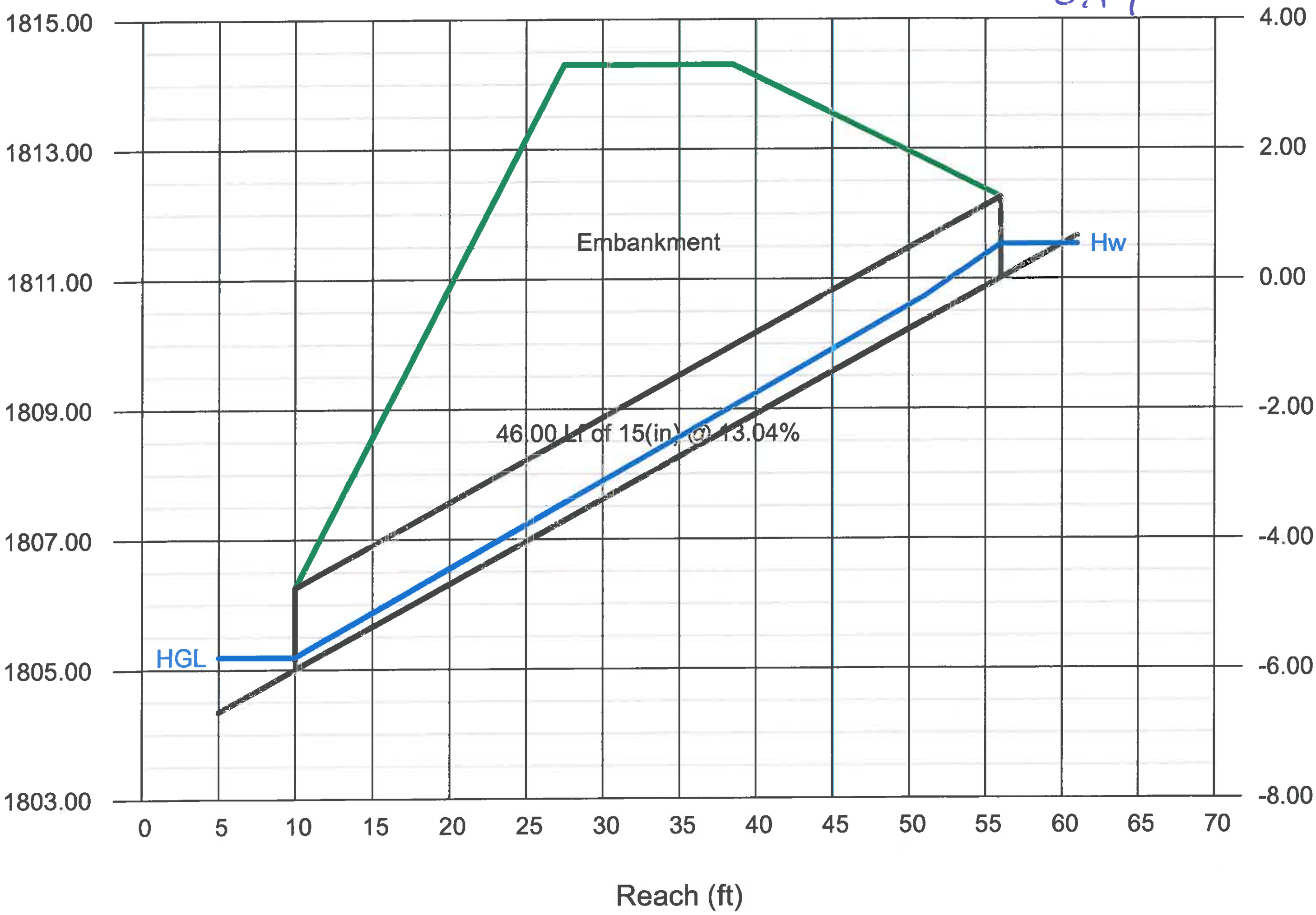
Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	2.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	1.00
Qpipe (cfs)	=	1.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.53
Veloc Up (ft/s)	=	3.00
* HGL Dn (ft)	=	1805.19
HGL Up (ft)	=	1811.40
Hw Elev (ft)	=	1811.53
Hw/D (ft)	=	0.42
Flow Regime	=	Inlet Control

1805.19 − 1805 = 0.19



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CEC-10.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 4.5	D= 1.25	Tw= 0.43	N

1) Apron Width at Outlet
Use Eq 3 4 Feet

2) Apron Length
Use Eq 1 15 Feet

3) Downstream Apron Width
Use Eq 4 18 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.28 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Wednesday, Oct 23 2013

CEC-10.0

Invert Elev Dn (ft)	=	1825.00
Pipe Length (ft)	=	48.00
Slope (%)	=	9.90
Invert Elev Up (ft)	=	1829.75
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1835.90
Top Width (ft)	=	11.00
Crest Width (ft)	=	20.00

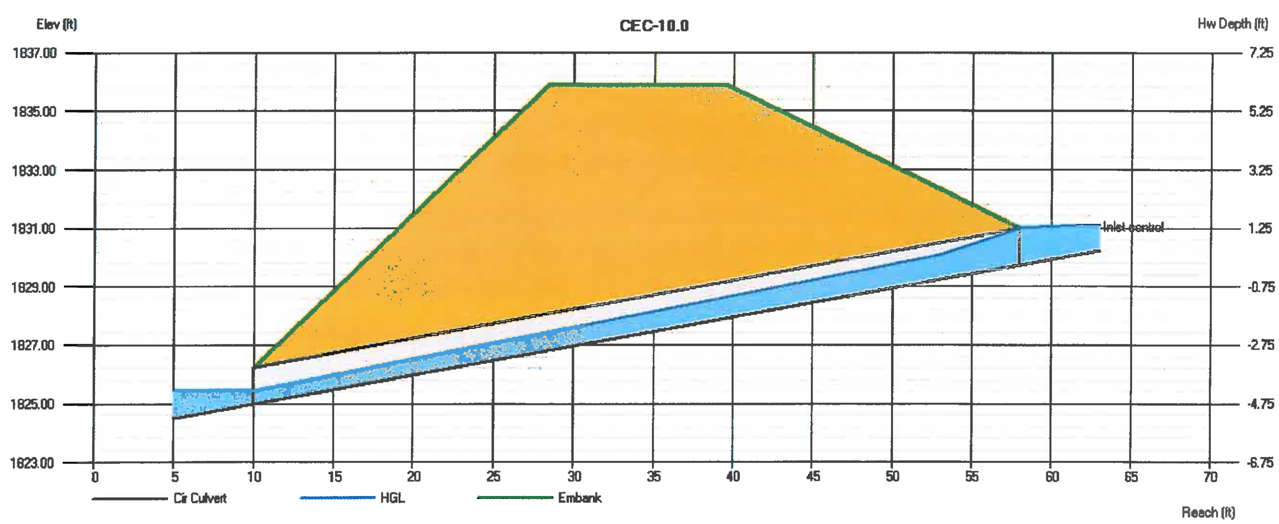
Calculations

Qmin (cfs)	=	4.00
Qmax (cfs)	=	5.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	4.50
Qpipe (cfs)	=	4.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	11.89
Veloc Up (ft/s)	=	4.98
HGL Dn (ft)	=	1825.43
HGL Up (ft)	=	1830.61
Hw Elev (ft)	=	1831.05
Hw/D (ft)	=	1.04
Flow Regime	=	Inlet Control

1825.43 − 1825.00 = 0.43



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $La = \dfrac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $La = \dfrac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-GCA-2.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 7.8	D= 1.25	Tw= 0.61	Y

1) Apron Width at Outlet

Use Channel Bottom Width for Feet

2) Apron Length

Use Eq 1 19 Feet

3) Downstream Apron Width

Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.41 Feet

Use Erosion Stone

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Thursday, Oct 24 2013

GCA-2.0

Invert Elev Dn (ft)	=	2187.00
Pipe Length (ft)	=	60.00
Slope (%)	=	9.17
Invert Elev Up (ft)	=	2192.50
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2196.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

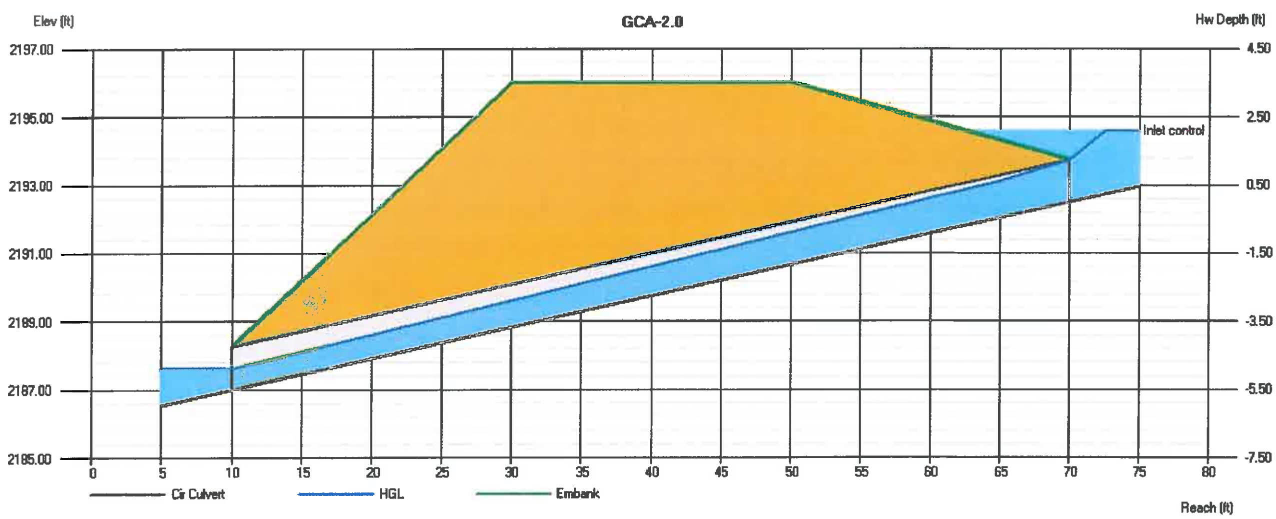
Calculations

Qmin (cfs)	=	7.00
Qmax (cfs)	=	8.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	7.80
Qpipe (cfs)	=	7.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	13.23
Veloc Up (ft/s)	=	6.79
HGL Dn (ft)	=	2187.61
HGL Up (ft)	=	2193.61
Hw Elev (ft)	=	2194.59
Hw/D (ft)	=	1.67
Flow Regime	=	Inlet Control

2187.61 - 2187.00 = 0.61'



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-GCA-5.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 3.4	D= 1.25	Tw= 0.46	n

1) Apron Width at Outlet

Use Eq 3 4 Feet

2) Apron Length

Use Eq 1 13 Feet

3) Downstream Apron Width

Use Eq 4 17 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.18 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. | Tuesday, Oct 22 2013

GCA-5.0

* Invert Elev Dn (ft)	=	2147.00
Pipe Length (ft)	=	63.00
Slope (%)	=	4.37
Invert Elev Up (ft)	=	2149.75
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2152.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

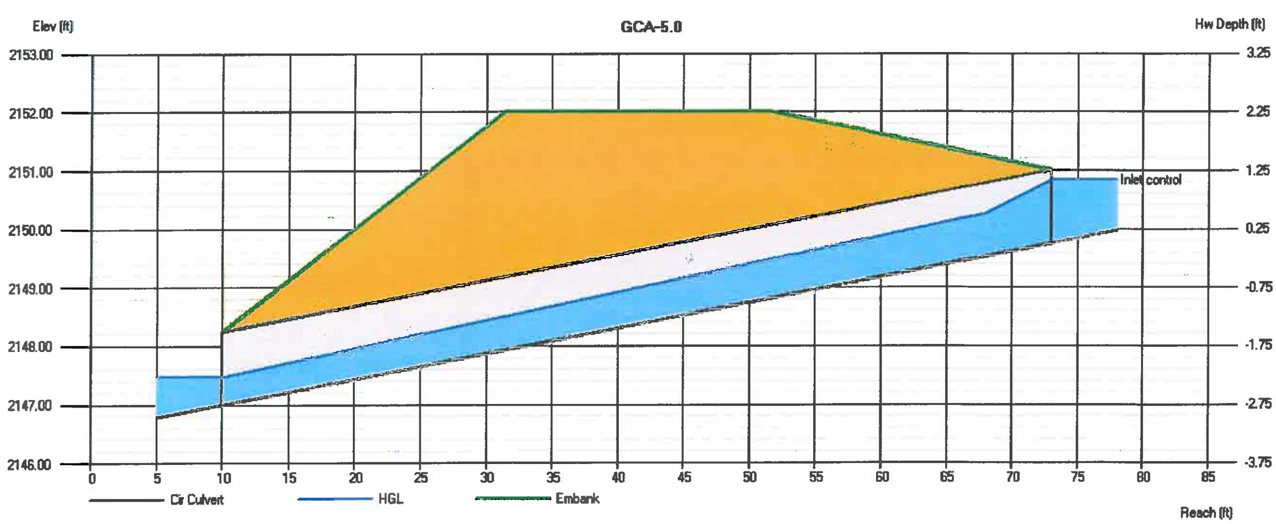
Calculations

Qmin (cfs)	=	3.00
Qmax (cfs)	=	4.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	3.40
Qpipe (cfs)	=	3.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.20
Veloc Up (ft/s)	=	4.45
* HGL Dn (ft)	=	2147.46
HGL Up (ft)	=	2150.50
Hw Elev (ft)	=	2150.84
Hw/D (ft)	=	0.87
Flow Regime	=	Inlet Control

2147.46 - 2147.00 = 0.46



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe use **Eq 1**:

$$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe use **Eq 2**:

$$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-GCA-3.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 10.4	D= 1.5	Tw= 0.58	N

1) Apron Width at Outlet
   Use Eq 3 — 5 Feet

2) Apron Length
   Use Eq 1 — 21 Feet

3) Downstream Apron Width
   Use Eq 4 — 25 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.52 Feet

Use Erosion Stone

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Thursday, Oct 24 2013

GCA-3.0

Invert Elev Dn (ft)	=	2135.50
Pipe Length (ft)	=	74.00
Slope (%)	=	13.51
Invert Elev Up (ft)	=	2145.50
Rise (in)	=	18.0
Shape	=	Cir
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2149.20
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

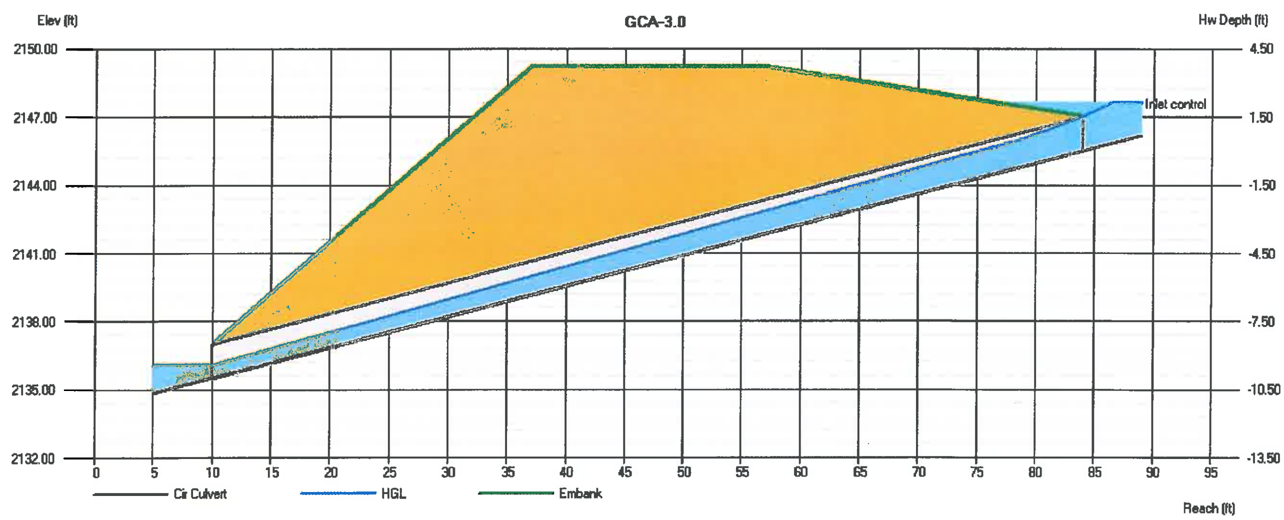
Calculations

Qmin (cfs)	=	10.00
Qmax (cfs)	=	11.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	10.40
Qpipe (cfs)	=	10.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	16.55
Veloc Up (ft/s)	=	6.64
HGL Dn (ft)	=	2136.08
HGL Up (ft)	=	2146.74
Hw Elev (ft)	=	2147.57
Hw/D (ft)	=	1.38
Flow Regime	=	Inlet Control

2136.08 - 2135.50 = 0.58



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-GCA-4.0 Outlet Protection

Data:	CFS	Feet	Feet	Channel (Y or N)
	Q= 11.8	D= 1.5	Tw= 0.66	N

1) Apron Width at Outlet
   Use Eq 3 — 5 Feet

2) Apron Length
   Use Eq 1 — 22 Feet

3) Downstream Apron Width
   Use Eq 4 — 27 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.54 Feet

Use Erosion Stone

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Thursday, Oct 24 2013

GCA-4.0

* Invert Elev Dn (ft)	=	2125.00
Pipe Length (ft)	=	110.00
Slope (%)	=	10.45
Invert Elev Up (ft)	=	2136.50
Rise (in)	=	18.0
Shape	=	Cir
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2140.70
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

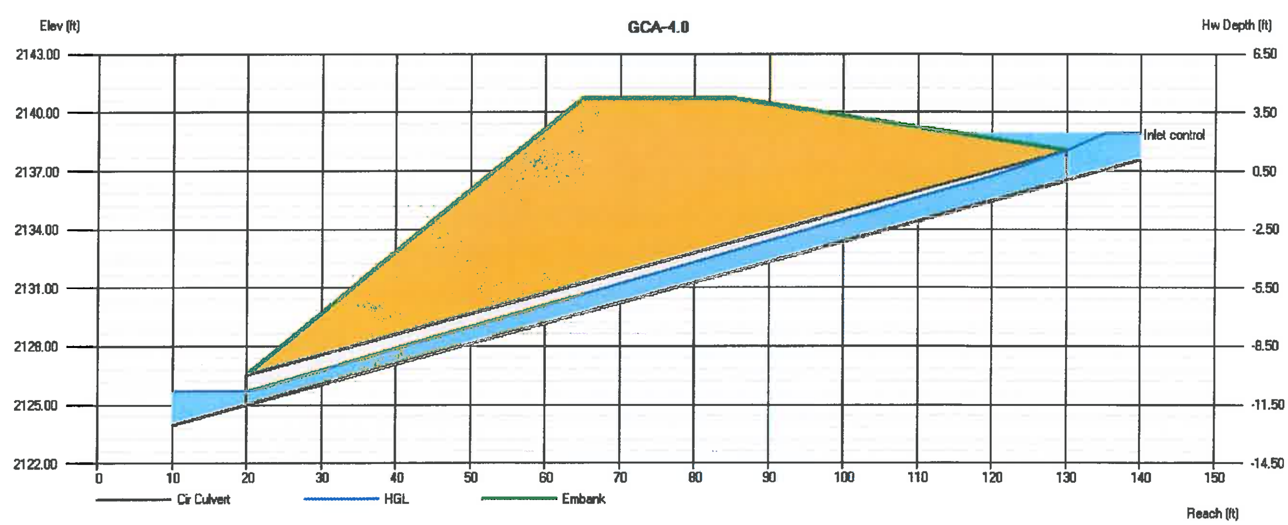
Calculations

Qmin (cfs)	=	11.00
Qmax (cfs)	=	12.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	11.80
Qpipe (cfs)	=	11.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	15.65
Veloc Up (ft/s)	=	7.22
* HGL Dn (ft)	=	2125.66
HGL Up (ft)	=	2137.81
Hw Elev (ft)	=	2138.87
Hw/D (ft)	=	1.58
Flow Regime	=	Inlet Control

2125.66 - 2125.00 = 0.66'



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-GCA-6.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 7.9	D= 1.5	Tw= 0.82	Y

1) Apron Width at Outlet
Use Channel Bottom Width for Feet

2) Apron Length
Use Eq 2 23 Feet

3) Downstream Apron Width
Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.26 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Thursday, Oct 24 2013

GCA-6.0

* Invert Elev Dn (ft)	=	2125.00
Pipe Length (ft)	=	90.00
Slope (%)	=	2.22
Invert Elev Up (ft)	=	2127.00
Rise (in)	=	18.0
Shape	=	Cir
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2131.80
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

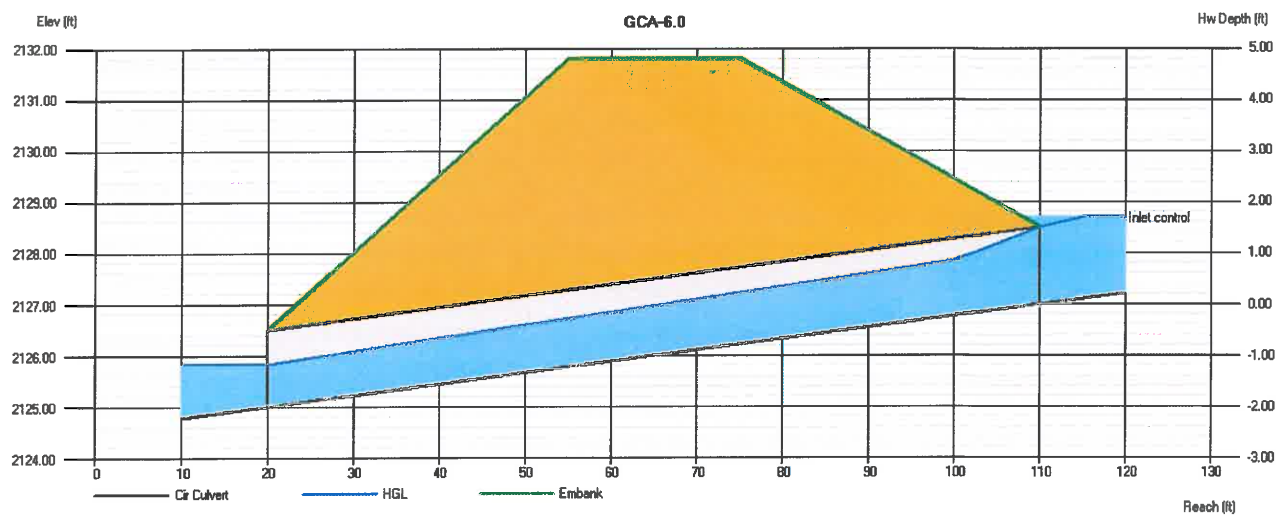
Calculations

Qmin (cfs)	=	7.00
Qmax (cfs)	=	8.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	7.90
Qpipe (cfs)	=	7.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.94
Veloc Up (ft/s)	=	5.73
* HGL Dn (ft)	=	2125.82
HGL Up (ft)	=	2128.09
Hw Elev (ft)	=	2128.69
Hw/D (ft)	=	1.13
Flow Regime	=	Inlet Control

2125.82 − 2125.00 = 0.82



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-G2CA-1.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 4.9	D= 1.25	Tw= 0.62	Y

1) Apron Width at Outlet
   Use Channel Bottom Width for Feet

2) Apron Length
   Use Eq 1 15 Feet

3) Downstream Apron Width
   Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.21 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. — Friday, Oct 25 2013

G2CA-1.0

* Invert Elev Dn (ft)	=	2099.00
Pipe Length (ft)	=	60.00
Slope (%)	=	3.33
Invert Elev Up (ft)	=	2101.00
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2106.10
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

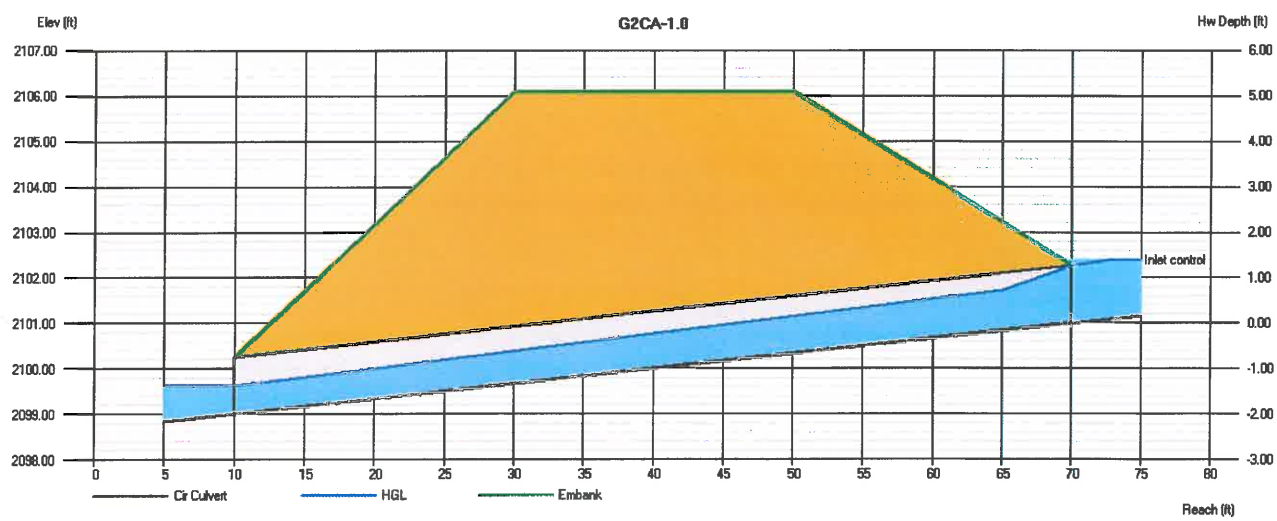
Calculations

Qmin (cfs)	=	4.00
Qmax (cfs)	=	5.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	4.90
Qpipe (cfs)	=	4.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.15
Veloc Up (ft/s)	=	5.19
* HGL Dn (ft)	=	2099.62
HGL Up (ft)	=	2101.90
Hw Elev (ft)	=	2102.39
Hw/D (ft)	=	1.11
Flow Regime	=	Inlet Control

2099.62 - 2099.00 = 0.62



Calculations 50 year storm

Project:	CEC CULVERTS
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe
use **Eq 1**: $La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe
use **Eq 2**: $La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel
Downstream Apron Width when there is **NO** well defined channel at pipe outlet
and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**
W=3D+La
or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**
W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-G2CA-2.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 6.7	D= 1.25	Tw= 1	Y

1) Apron Width at Outlet
   Use Channel Bottom Width for Feet

2) Apron Length
   Use Eq 2 23 Feet

3) Downstream Apron Width
   Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.20 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Friday, Oct 25 2013

G2CA-2.0

Invert Elev Dn (ft)	=	2094.75
Pipe Length (ft)	=	91.00
Slope (%)	=	1.08
Invert Elev Up (ft)	=	2095.73
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	2101.50
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

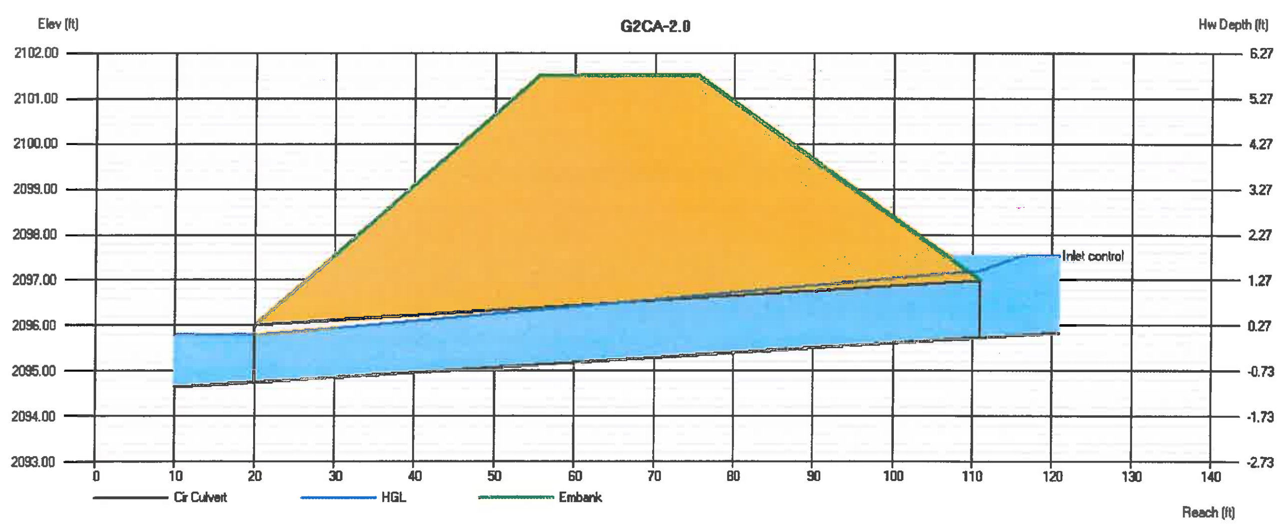
Calculations

Qmin (cfs)	=	6.00
Qmax (cfs)	=	7.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	6.70
Qpipe (cfs)	=	6.70
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.12
Veloc Up (ft/s)	=	5.46
HGL Dn (ft)	=	2095.79
HGL Up (ft)	=	2097.20
Hw Elev (ft)	=	2097.53
Hw/D (ft)	=	1.44
Flow Regime	=	Inlet Control

2095.79 − 2094.75 = 1.04



B. Substation Interconnection Station

Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/15/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2:** $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CV2 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 3.55	D= 1.25	Tw= 0.6867	n

1) Apron Width at Outlet

   Use Eq 3 4 Feet

2) Apron Length

   Use Eq 2 16 Feet

3) Downstream Apron Width

   Use Eq 5 10 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.13 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Tuesday, Oct 15 2013

Culvert CV2 Outlet

Invert Elev Dn (ft)	=	607.00
Pipe Length (ft)	=	65.00
Slope (%)	=	1.15
Invert Elev Up (ft)	=	607.75
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

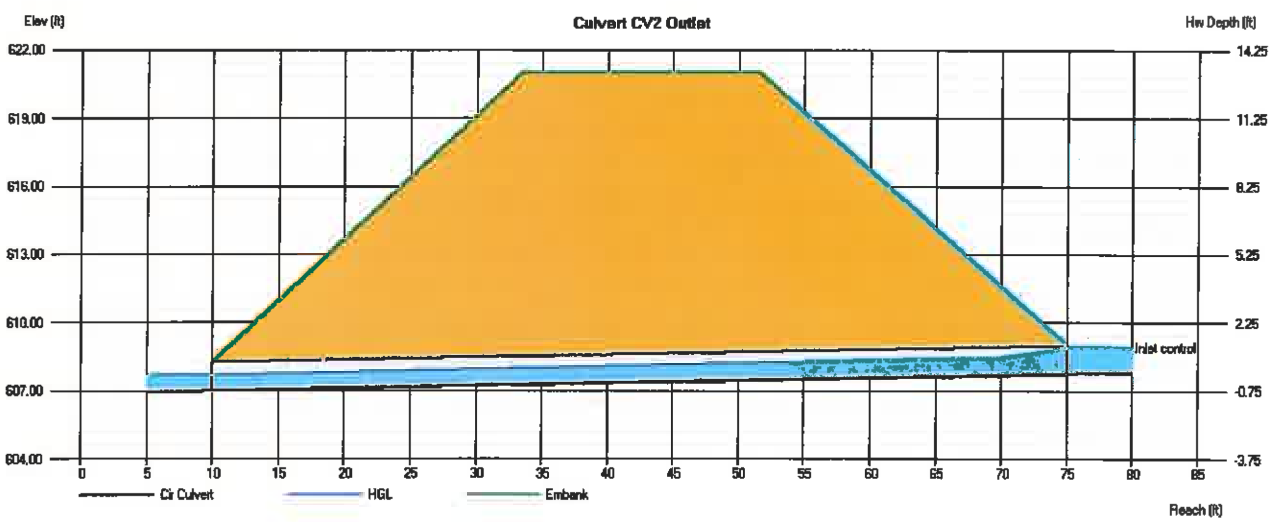
Top Elevation (ft)	=	621.00
Top Width (ft)	=	18.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	3.00
Qmax (cfs)	=	4.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	3.50
Qpipe (cfs)	=	3.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.07
Veloc Up (ft/s)	=	4.50
HGL Dn (ft)	=	607.69
HGL Up (ft)	=	608.51
Hw Elev (ft)	=	608.90
Hw/D (ft)	=	0.92
Flow Regime	=	Inlet Control



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/15/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-MP1 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 3.7	D= 1.25	Tw= 0.3525	n

1) Apron Width at Outlet

Use Eq 3 4 Feet

2) Apron Length

Use Eq 1 14 Feet

3) Downstream Apron Width

Use Eq 4 17 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.26 Feet

Use NHDOT Class C Stone Fill

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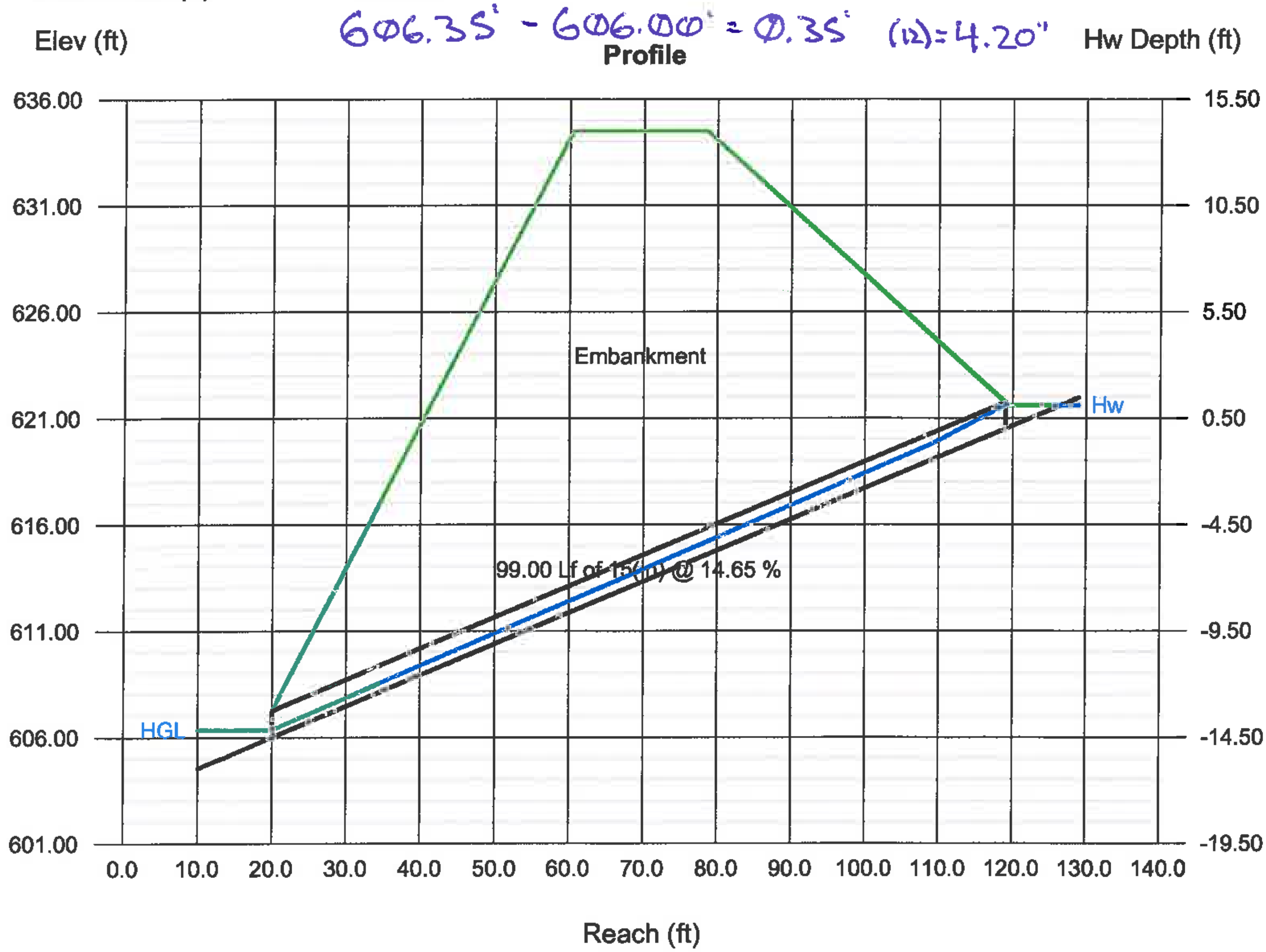
Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. Friday, Nov 22 2013

Culvert MP1 Outlet

* Invert Elev Dn (ft)	= 606.00	**Calculations**	
Pipe Length (ft)	= 99.00	Qmin (cfs)	= 3.00
Slope (%)	= 14.65	Qmax (cfs)	= 4.00
Invert Elev Up (ft)	= 620.50	Tailwater Elev (ft)	= Critical
Rise (in)	= 15.0		
Shape	= Circular	**Highlighted**	
Span (in)	= 15.0	Qtotal (cfs)	= 3.70
No. Barrels	= 1	Qpipe (cfs)	= 3.70
n-Value	= 0.015	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 13.01
Culvert Entrance	= Square edge w/headwall (C)	Veloc Up (ft/s)	= 4.62
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5	* HGL Dn (ft)	= 606.35
		HGL Up (ft)	= 621.28
Embankment		Hw Elev (ft)	= 621.61
Top Elevation (ft)	= 634.50	Hw/D (ft)	= 0.88
Top Width (ft)	= 18.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 200.00		

606.35' - 606.00' = 0.35' (12) = 4.20"



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/15/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe use **Eq 1**:

$$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe use **Eq 2**:

$$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-INF1 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 1.97	D= 1	Tw= 0.2575	n

1) Apron Width at Outlet
   Use Eq 3 — 3 Feet

2) Apron Length
   Use Eq 1 — 11 Feet

3) Downstream Apron Width
   Use Eq 4 — 14 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.19 Feet

Use NHDOT Class C Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. | Friday, Nov 22 2013

Culvert INF1 Outlet

Invert Elev Dn (ft)	= 625.50
Pipe Length (ft)	= 38.00
Slope (%)	= 20.13
Invert Elev Up (ft)	= 633.15
Rise (in)	= 12.0
Shape	= Circular
Span (in)	= 12.0
No. Barrels	= 1
n-Value	= 0.015
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	= 637.00
Top Width (ft)	= 6.00
Crest Width (ft)	= 50.00

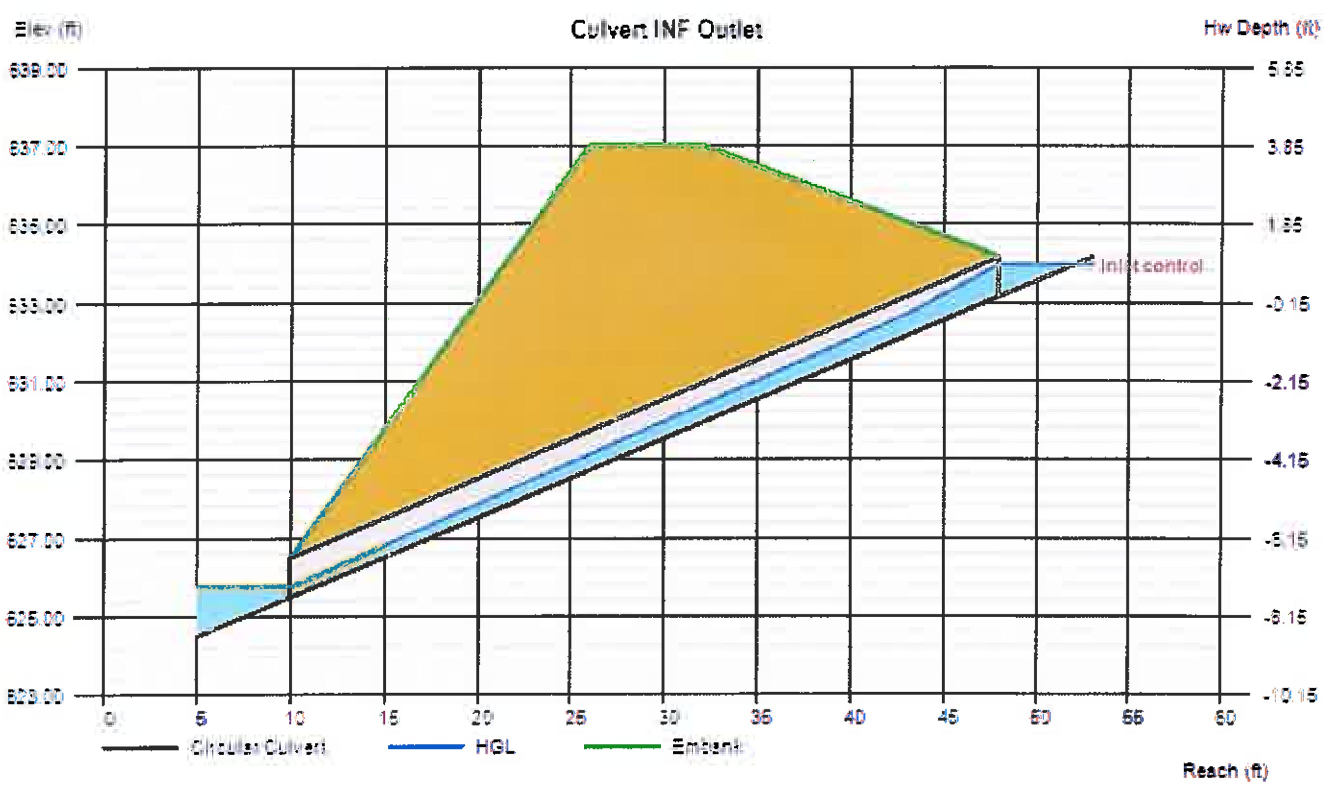
Calculations

Qmin (cfs)	= 1.50
Qmax (cfs)	= 2.50
Tailwater Elev (ft)	= Critical

Highlighted

Qtotal (cfs)	= 1.97
Qpipe (cfs)	= 1.97
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 12.29
Veloc Up (ft/s)	= 4.02
HGL Dn (ft)	= 625.76
HGL Up (ft)	= 633.75
Hw Elev (ft)	= 633.96
Hw/D (ft)	= 0.81
Flow Regime	= Inlet Control

625.76' − 625.50' = 0.26' (12) = 3.12"



Calculations 50 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/15/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe use **Eq 1**:

$$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe use **Eq 2**:

$$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter; La= apron length; W= apron width

Q=Discharge from pipe CFS; Tw=Tailwater

Culvert-CV1 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 50.43	D= 4	Tw= 0.86	n

1) Apron Width at Outlet
   Use Eq 3 — 12 Feet

2) Apron Length
   Use Eq 1 — 39 Feet

3) Downstream Apron Width
   Use Eq 4 — 51 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

1.08 Feet

Use NHDOT Class B Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Tuesday, Oct 15 2013

Cir Culvert

Invert Elev Dn (ft)	=	606.00
Pipe Length (ft)	=	120.00
Slope (%)	=	14.17
Invert Elev Up (ft)	=	623.00
Rise (in)	=	48.0
Shape	=	Cir
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.013
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	=	634.50
Top Width (ft)	=	18.00
Crest Width (ft)	=	200.00

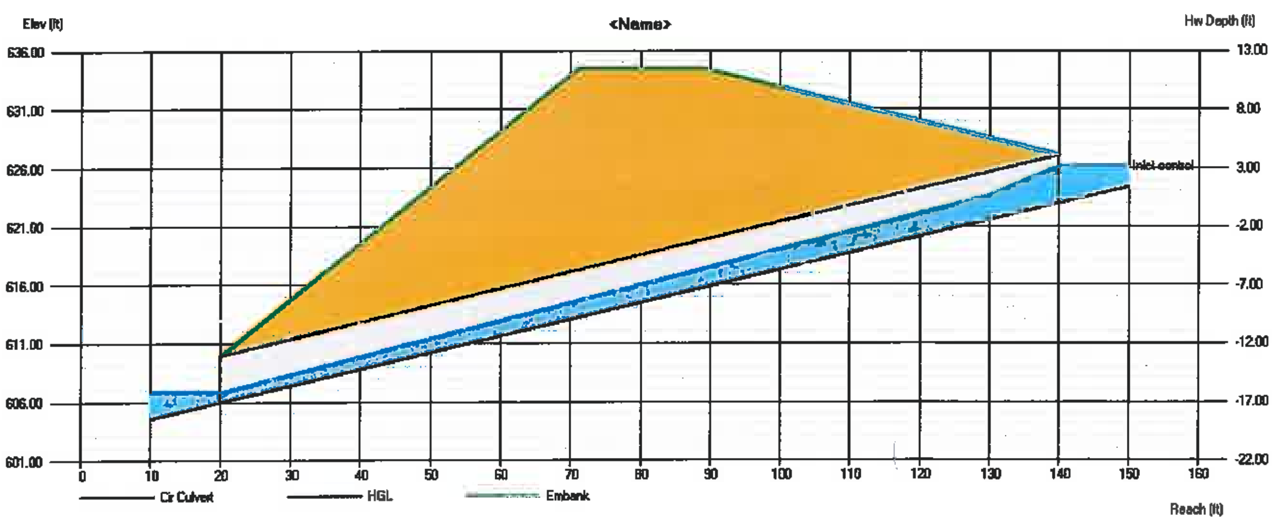
Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	51.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	50.40
Qpipe (cfs)	=	50.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	25.36
Veloc Up (ft/s)	=	7.37
HGL Dn (ft)	=	606.86
HGL Up (ft)	=	625.14
Hw Elev (ft)	=	626.10
Hw/D (ft)	=	0.78
Flow Regime	=	Inlet Control

TW = 606.86 − 606.00 = 0.86' (12) = 10.33"



Calculations 25 year storm

Project:	Wild Meadows Substation
Performed By:	DEB
Checked By:	AJC
Date:	10/15/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe use **Eq 1**:

$$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe use **Eq 2**:

$$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-CV1 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 37.26	D= 4	Tw= 0.7258	n

1) Apron Width at Outlet
   Use Eq 3 12 Feet

2) Apron Length
   Use Eq 1 36 Feet

3) Downstream Apron Width
   Use Eq 4 48 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.86 Feet

Use NHDOT Class B Stone Fill

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. Friday, Nov 22 2013

Culvert CV1 Tailwater depth (25yr)

Invert Elev Dn (ft)	=	606.00
Pipe Length (ft)	=	120.00
Slope (%)	=	14.17
Invert Elev Up (ft)	=	623.00
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

Top Elevation (ft)	=	634.50
Top Width (ft)	=	18.00
Crest Width (ft)	=	200.00

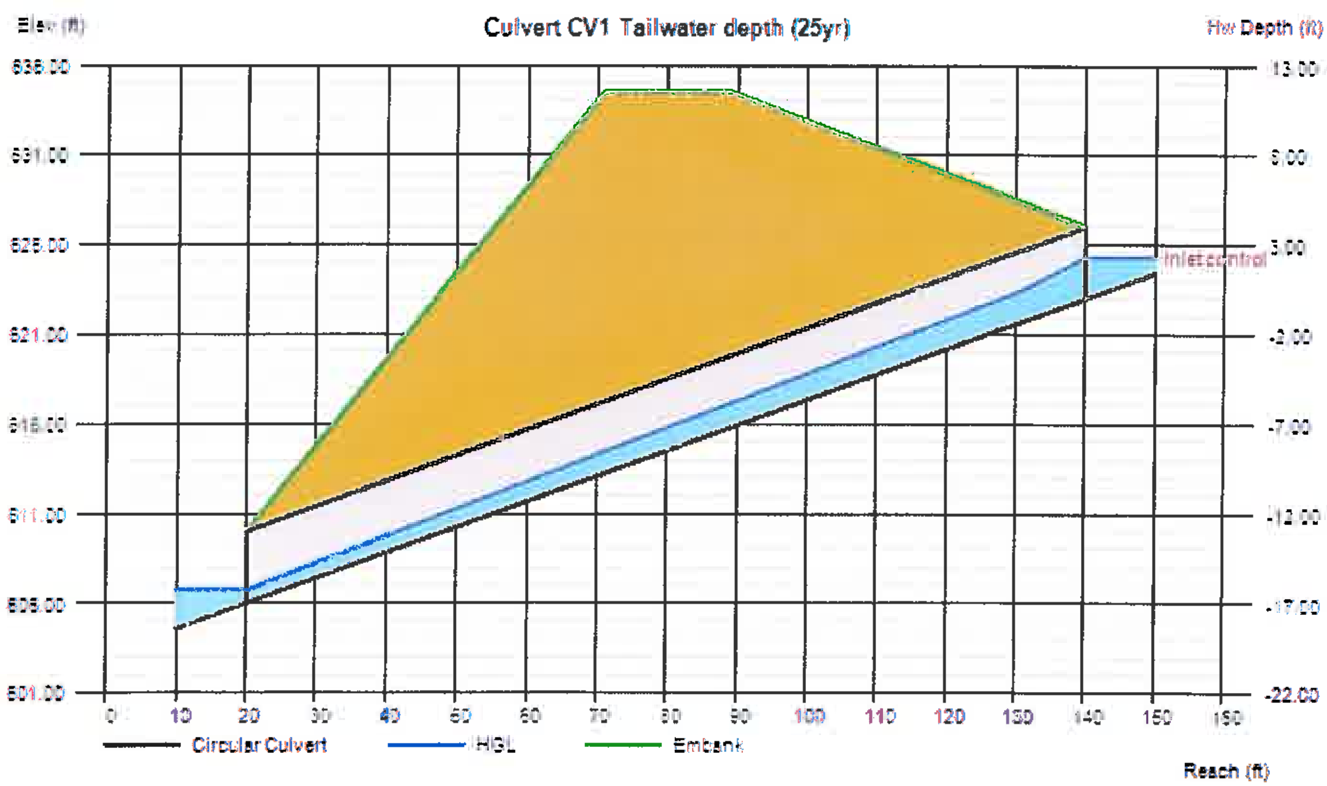
Calculations

Qmin (cfs)	=	37.00
Qmax (cfs)	=	38.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	37.26
Qpipe (cfs)	=	37.26
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	23.95
Veloc Up (ft/s)	=	6.71
HGL Dn (ft)	=	606.73
HGL Up (ft)	=	624.82
Hw Elev (ft)	=	625.32
Hw/D (ft)	=	0.58
Flow Regime	=	Inlet Control

606.73' - 606.00' = 0.73' (12) = 8.76"



C. Operation and Maintenance Building

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Friday, Nov 15 2013

WMAC-1.0

Invert Elev Dn (ft)	=	1356.00
Pipe Length (ft)	=	88.00
Slope (%)	=	0.57
Invert Elev Up (ft)	=	1356.50
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1360.00
Top Width (ft)	=	16.00
Crest Width (ft)	=	75.00

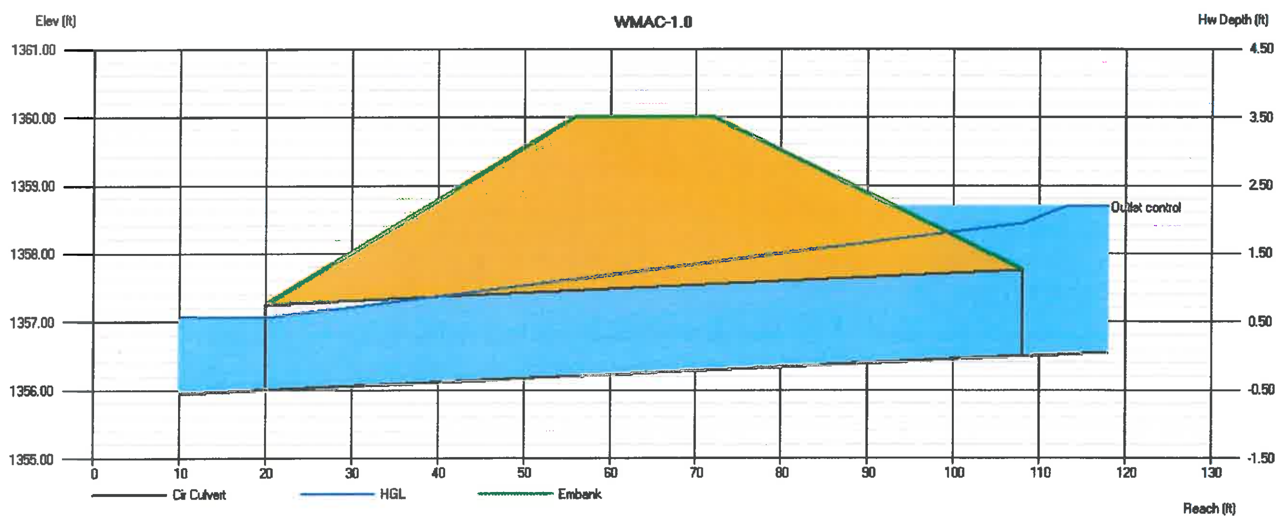
Calculations

Qmin (cfs)	=	6.00
Qmax (cfs)	=	7.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	6.80
Qpipe (cfs)	=	6.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.18
Veloc Up (ft/s)	=	5.54
HGL Dn (ft)	=	1357.05
HGL Up (ft)	=	1358.44
Hw Elev (ft)	=	1358.68
Hw/D (ft)	=	1.74
Flow Regime	=	Outlet Control

1357.05 - 1356.00 = 1.05



Calculations 50 year storm

Project:	Wild Meadows Operations and Maintenance Facility
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-WMAC-2.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 4.7	D= 1.25	Tw= 0.68	y

1) Apron Width at Outlet

Use Channel Bottom Width for Feet

2) Apron Length

Use Eq 2 19 Feet

3) Downstream Apron Width

Use Channel Bottom Width for Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.19 Feet

Use NHDOT Class C Stone Fill

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Calculations 50 year storm

Project:	Wild Meadows Operations and Maintenance Facility
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-WMAC-1.0 Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 6.8	D= 1.25	Tw= 1.05	n

1) Apron Width at Outlet

   Use Eq 3 4 Feet

2) Apron Length

   Use Eq 2 23 Feet

3) Downstream Apron Width

   Use Eq 5 13 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.20 Feet

Use NHDOT Class C Stone Fill

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Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc.

Friday, Nov 15 2013

WMAC-2.0

* Invert Elev Dn (ft)	=	1361.00
Pipe Length (ft)	=	70.00
Slope (%)	=	2.14
Invert Elev Up (ft)	=	1362.50
Rise (in)	=	15.0
Shape	=	Cir
Span (in)	=	15.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

Top Elevation (ft)	=	1366.00
Top Width (ft)	=	16.00
Crest Width (ft)	=	100.00

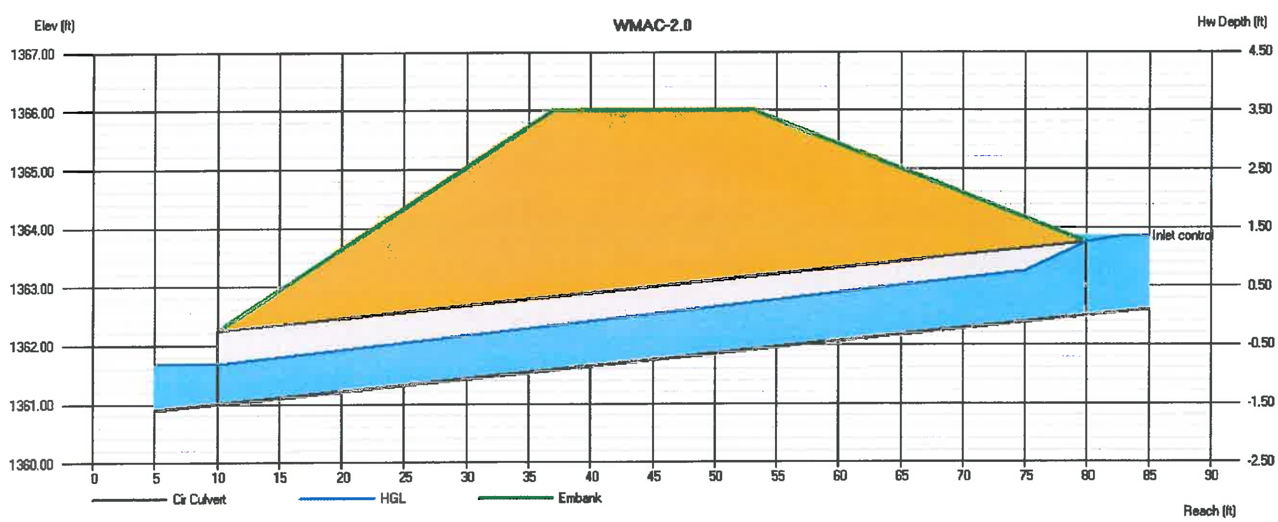
Calculations

Qmin (cfs)	=	4.00
Qmax (cfs)	=	5.00
Tailwater Elev (ft)	=	Critical

Highlighted

Qtotal (cfs)	=	4.70
Qpipe (cfs)	=	4.70
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.88
Veloc Up (ft/s)	=	5.08
* HGL Dn (ft)	=	1361.68
HGL Up (ft)	=	1363.38
Hw Elev (ft)	=	1363.85
Hw/D (ft)	=	1.08
Flow Regime	=	Inlet Control

1361.68 − 1361.00 = 0.68



Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Monday, Oct 21 2013

12 inch Pond Outlet Pipe O+M

Invert Elev Dn (ft)	=	1354.00
Pipe Length (ft)	=	35.00
Slope (%)	=	2.91
Invert Elev Up (ft)	=	1355.02
Rise (in)	=	12.0
Shape	=	Cir
Span (in)	=	12.0
No. Barrels	=	1
n-Value	=	0.015
Inlet Edge	=	Projecting
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.5

Embankment

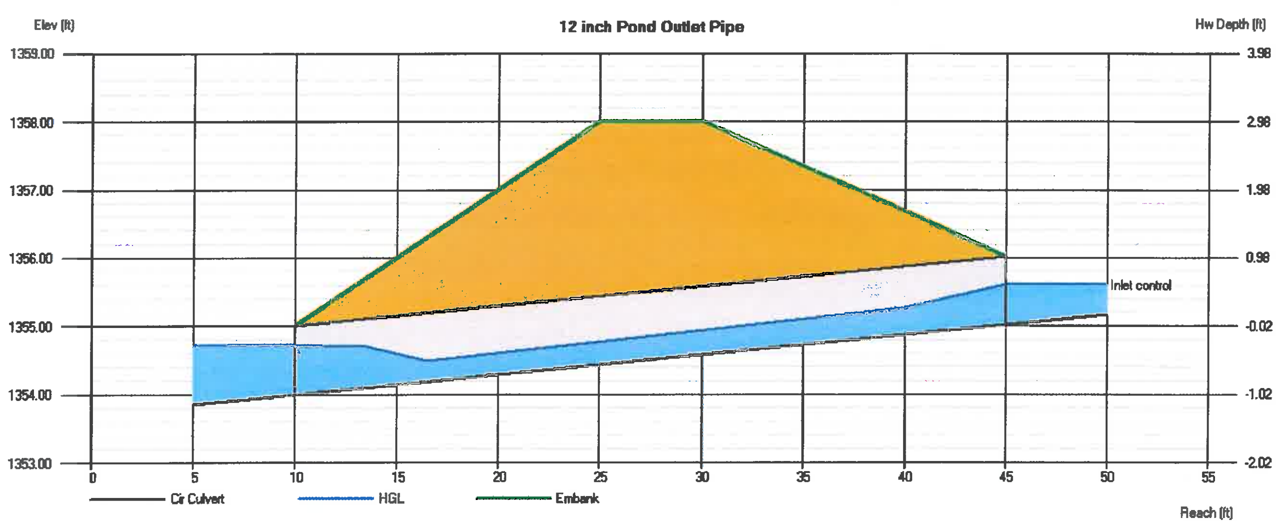
Top Elevation (ft)	=	1358.00
Top Width (ft)	=	5.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	1.40
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	1.00
Qpipe (cfs)	=	1.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.67
Veloc Up (ft/s)	=	3.17
HGL Dn (ft)	=	1354.71
HGL Up (ft)	=	1355.44
Hw Elev (ft)	=	1355.61
Hw/D (ft)	=	0.59
Flow Regime	=	Inlet Control



TW = 1354.71 - 1354.00 = 0.71'

Calculations 50 year storm

Project:	Wild Meadows Operations and Maintenance Facility
Performed By:	JCD
Checked By:	AJC
Date:	10/16/2013

Apron Length

When Tail water depth at pipe outlet is **less (<)** than 1/2 the dia. pipe

use **Eq 1**: $$La = \frac{1.8 \times Q}{D^{3/2}} + 7 \times D$$

When Tail water depth at pipe outlet is **greater (>)** than 1/2 the dia. pipe

use **Eq 2**: $$La = \frac{3 \times Q}{D^{3/2}} + 7 \times D$$

Apron Width at Outlet = 3 x D **Eq3** or channel bottom width, when there is a well defined channel

Downstream Apron Width when there is **NO** well defined channel at pipe outlet

and the Tailwater Depth is less (<) than the elevation of the center of the pipe use **Eq 4**

W=3D+La

or if the Tailwater Depth is greater (>) than the elevation of the center of the pipe use **Eq 5**

W=3D+0.4xLa

Where D= pipe Diameter La= apron length W= apron width

Q=Discharge from pipe CFS Tw=Tailwater

Culvert-12" Pond Outlet Pipe Outlet Protection

	CFS	Feet	Feet	Channel (Y or N)
Data:	Q= 1.1	D= 1	Tw= 0.71	n

1) Apron Width at Outlet

 Use Eq 3 — 3 Feet

2) Apron Length

 Use Eq 2 — 10 Feet

3) Downstream Apron Width

 Use Eq 5 — 7 Feet

4) Stone Size

$$d50 = \frac{0.02 \times Q^{4/3}}{Tw \times D}$$

0.03 Feet

Use NHDOT Class C Stone Fill

P:\13185 IRF12\DOCS\PERMITS\AOT\O&M Cal Sheets BMP\O-M Stone Sizing Outlet Protection.xls

3.6 Site Specific Soil Survey
By
Lobdell Associates, Inc.

LOBDELL ASSOCIATES INC.
Environmental & Community Planning

To: Art Colvin, PE, Horizons Engineering

From: Ray Lobdell, Certified Soil Scientist

Date: 10/25/1013

Subject: Wild Meadows Windpark; Soil Auguring at Potential Swale Sites

As requested, I visited the 14 additional proposed swale sites at the Wild Meadows Windpark for the purpose of soil auguring and determining the presence of watertables, if any. The locations of the 14 sites were provided to me digitally and I navigated to each using a handheld Trimble GeoExplorer GPS unit. I numbered each of the sites and flagged those numbers in the field.

Field work was done using a handheld tiling spade, auger and/or ledge probe. Depth of observation did not generally exceed 40 inches. If refusal was obtained before reaching 40 inches, it is noted as to my professional opinion whether the refusal was bedrock or large boulders. Several probes were often made at the sites if refusal encountered in order to maximize the depth.

Soil Logs are provided below.

LOBDELL ASSOCIATES INC.

Environmental & Community Planning

Swale Site Visits-Soil Auguring Summary

Job:	Wild Meadows	**Map Key:**	1	**Date:**	10/7/13		
Horizon	**Depth (")**	**Color**	**Redox**	**Texture**			
^A	0-4	10YR3/2		FSL			
^E	4-6	10YR6/1		FSL			
^B1	6-18	7.5YR4/4		FSL			
^BC	24-32	2.5YR6/6		FSL			
C	24-40	5Y5/6		VFSL			
Restrictive Layer:	NONE-C firm in place	SHWT:	NONE	OWT:	NONE		
Depth Augured:	40"	Comments: At upper edge log yard-disturbed. Deep hardpan (restrictive) layer in nearby borrow areas.					

Job	Wild Meadows	**Map Key:**	2	**Date:**	10/7/13		
Horizon	**Depth (")**	**Color**	**Redox**	**Texture**			
A	0-3	7.5YR2.5/2		VFSL			
E	3-4	7.5YR5/2		FSL			
B	4-8	2.5YR3/2710YR6/4		VFSL			
C	8-28	10YR4/4					
Restrictive Layer:	NONE	**SHWT**	NONE	**OWT:**	**NONE**	Ledge	28"
Depth Augured:	28	Comment: Few, fine mottles in C. Near flagged wetland.					

Job:	Wild Meadows	**Map Key:**	3	**Date:**	10/7/13		
Horizon	**Depth (")**	**Color**	**Redox**	**Texture**			
O	2-0	7.5R4/8		Wood fiber			
A	0-2	2.5YR2.5/2		VFSL			
E	2-4	2.5YR7/1		VFSL			
B1	4-18	5YR4/4		VFSL			
B2	18-24	10YR4/4		VFSL			
C	24-36	2.5Y5/3		VFSL			
Restrictive Layer:	NONE-LEDGE	SHWT	NONE	OWT:	NONE	Ledge	36"

Depth Augured:	46”	Comment: In field. Ground frozen. No auguring possible. See 1a.					

Job:	Wild Meadows	**Map Key:**	4	**Date:**	10/9/13		
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			
0	2-0	7.5R3/3		Wood fiber			
E	0-4	10YR6/1		FSL			
B1	4-7	2.5Y3/8		FSL			
B2	7-18	2.5YR3/8		FSL			
B3	18-28	7.5YR5/6		FSL			
Restrictive Layer:	NONE	**SHWT**	NONE	**OWT:**	NONE	**Ledge**	28”?
Depth Augured:	28” Refusal	Comments: Ledge variable in area. Large surface boulders common.					

Job:	Wild Meadows	**Map Key:**	5	**Date:**	10/9/13		
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			
A	0-2	7.5YR2.5/2		FSL			
B1	2-6	5YR3/4		FSL			
B2	6-26	2.5YR3/4		FSL			
C	26-30	7.5YR4/2		FSL			
Restrictive Layer:	None	SHWT	NONE	OWT:	NONE	LEDGE	30”?
Depth Augured:	30” Refusal	Comments: Large surface boulders.					

Job:	Wild Meadows	**Map Key:**	6	**Date:**	10/9/13		
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			
A	0-3	5YR2.5/1		VFSL			
E	3-4	10YR6/1		FSL			
B1	4-10	10YR3/6		FSL			
B2	10-20	7.5TR5/6		FSL			
B3	20-27	10YR5/6		FSL			
Restrictive Layer:	NONE	SHWT	NONE	OWT:	NONE	LEDGE	NONE
Depth Augured:	27”	Comments: Stones/boulders prevented deeper observation.					
Job:	Wild Meadows	**Map Key:**	7	**Date:**	10/9/13		
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			

A	0-6	7.5YR2.5/1	-	FSL			
B1	6-9	10YR3/3		FSL			
B2	9-17	10YR4/6		FSL			
B3	17-26	2.5Y5/4		FSL			
Cd	26-40	5Y5/3	7.5YR5/6	VFSL			
Restrictive Layer:	26”	SHWT	26”	OWT:	NONE*	LEDGE	NONE
Depth Augured:	40”	Comments: *Soil saturated above pan from recent rain.					
Job:	Wild Meadows		**Map Key:**	8	**Date:**	10/9/13	
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			
A	0-3	10YR3/2		FSL			
E	3-6	10YR6/1		FSL			
B	6-8	2.5YR3/4		FSL			
B	8-15	10YR5/6		FSL			
BC	15-24	2.5Y5/6		VFSL			
Cd	24-40	5Y5/3	2.5YR5/6	VFSL			
Restrictive Layer:	24”	SHWT	None	OWT:	NONE	LEDGE	NONE
Depth Augured:	40”	Comments: Hardpan; Few boulders; Redox few and faint; Ledge possible below observation.					
Job:	Wild Meadows		**Map Key:**	9	**Date:**	10/9/13	
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			
A	0-2	10YR3/2		VFSL			
E	2-4	5YR6/2		VFSL			
B	4-8	10YR4/6		VFSL			
B	8-20	7.5YR3/4		VFSL			
B/C	20-24	7.5YR4/4	10YR6/8/ AT TOP OF PAN	VFSL			
Restrictive Layer:	NONE	SHWT	NONE	OWT:	NONE	LEDGE	24”
Depth Augured:	24”	Comments: Large outcrops and boulders. Area clear cut for met tower.					
Job:	Wild Meadows		**Map Key:**	10	**Date:**	10/24/13	
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			
A	0-5	5YR3/1		FSL			
E	5-6	7.5YR7/1		FSL			
B	6-12	7.5YR3/3		FSL			
Restrictive	NONE	SHWT	NONE	OWT:	NONE	LEDGE	12”

Layer:							
Depth Augured:	12”	Comments: Large outcrops and boulders. Ledge 0-24” around site.					
Job:	Wild Meadows	**Map Key:**	11	**Date:**	1024/13		
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			
A	0-3	10YR3/2		FSL			
B	2-24	10YR5/6		FSL			
Restrictive Layer:	NONE	SHWT	NONE	OWT:	NONE	LEDGE	24”
Depth Augured:	24”	Comments: Shallow to ledge may range 1-3 feet.					
Job:	Wild Meadows	**Map Key:**	12	**Date:**	10/24/13		
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			
A	0-4	10R2.5/1	-	VFSL			
Bg	4-18	7/5PB	7.5YR4/4	FSL			
Restrictive Layer:	NONE	SHWT	6”	OWT:	6”	LEDGE	NONE
Depth Augured:	18”	Comments: Site in flagged wetland. Moved 50’ uphill and still hydric soils just beyond wetland flag.					
Job:	Wild Meadows	**Map Key:**	13	**Date:**	10/24/13		
Horizon	**Depth (“)**	**Color**	**Redox**	**Texture**			
A	0-3	10YR3/3		FSL			
B	3-13	10YR5/6		FSL			
B	13-30	7.5YR7/6		FSL			
C	30-40	2.5Y5/4		FSL			
Restrictive Layer:	NONE	SHWT	NONE	OWT:	NONE	LEDGE	NONE
Depth Augured:	24”	Comments: C with lenses of ls; C firm in place, possible coarse pan.					
Job:	Wild Meadows	**Map Key:**	14	**Date:**	10/24/13		
Horizon	**Depth**	**Color**	**Redox**	**Texture**			

	(“)						
^Ou*	0-24	-		Wood debris-HTM-transported			
^C1*	24-30	10Y53/2&10YR5/6		FSL			
^C2*	30-40	10YR2/2		FSL			
Restrictive Layer:	NONE	SHWT	NONE	OWT:	NONE	LEDGE	NONE
Depth Augured:	40”	Comments: *Area excavated then filled with stumps etc. Need backhoe to truly evaluate.					

Site-Specific Soil Survey Report

Wild Meadows Wind Farm
Proposed Substation Facility

prepared for

Horizons Engineering
34 School Street
Littleton, NH 03561

December, 2012

Lobdell Associates Inc.
88 Gale Chandler Road
Landaff, NH 03585
603-838-6880

Introduction

This report accompanies a site-specific soil survey completed by Raymond Lobdell, NH certified soil scientist prepared to comply with NHDES AoT rules. The mapping was completed according to the standards in the report "Site-Specific Soil Mapping Standards for NH and VT.", Special Publication #3, as revised, by the Society of Soil Scientists of Northern New England. Note recent changes with regard to disturbed soil mapping units.

Methodology

Mapping was completed using a hand auger and tiling spade in November, 2012.

The mapping was done on an existing conditions map prepared by Horizons Engineering at a scale of 1" = 50'. Existing topography included 2 foot contour intervals. Ground control included existing land use.

The purpose of the site specific soil mapping was to comply with NHDES AoT rules. The entire lot was not mapped, only the areas to be disturbed.

Note that portions of the site have been disturbed and thus the disturbed mapping unit symbol supplements have been used.

Wetlands were delineated and surveyed on to existing conditions plan by others.

Site

The site is located in the northwest section of the town of Alexandria on the west side Bog Road and the DC powerline right of way, about 1.2 miles north of the junction of Bog Road and Route 104. A portion of the site is an old gravel pit.

The sloping site is located at elevations ranging from about 606 to 670 feet above sea level. The site generally slopes to the southeast with an undulating topography with slopes ranging generally from flat to over 35 percent. Soils are glacial till and glacial outwash.

A large portion of the site has been excavated, in many cases down to bedrock. Additionally, some excavated areas have been filled with stumps, boulders and rocks. The non-disturbed areas are forested.

Map Legend

Table 1 contains a map legend of the mapping units delineated on the site. The soil mapping units utilize NRCS/NCSS taxonomic class name at the series level with accompanying phase terms. Additionally disturbed units have been delineated using the new 5 symbol Disturbed Mapping Unit Supplement to the Site Specific Soil Mapping Standard for NH and VT (SSSNNE Special Publication #3) shown as "*NRCS Map Symbol/SSSNNE Disturbed Soil Supplement Symbol*" which provides additional information on disturbed units.

Also included in Table 1 are slope groupings, drainage classes, hydrologic groupings and Ksat values.

Table 1
Site-Specific Soil Survey Map Unit Key

Mapping Unit Symbol	Soil Mapping Unit Name	Slope Grouping	Drainage Class	Hydrologic Group	Ksat* low-B (in/hr)	Ksat* high-B (in/hr)	Ksat* low-C (in/hr)	Ksat* high-C (in/hr)
36C	Adams	8-15%	Excessively Drained	A	6.0	20.0	20.0	99.0
92B	Lyman very stony	3-8%	Somewhat Excessively Drained	D**	2.0	6.0	2.0	6.0
92C	Lyman very stony	8-15%	Somewhat Excessively Drained	D**	2.0	6.0	2.0	6.0
92D	Lyman very stony	15-25%	Somewhat Excessively Drained	D**	2.0	6.0	2.0	6.0
92E	Lyman very stony	25-35%	Somewhat Excessively Drained	D**	2.0	6.0	2.0	6.0
92F	Lyman very stony	>35%	Somewhat Excessively Drained	D**	2.0	6.0	2.0	6.0
99B	Tunbridge very stony	3-8%	Well Drained	C	0.6	6.0	0.6	6.0
99C	Tunbridge very stony	8-15%	Well Drained	C	0.6	6.0	0.6	6.0
99D	Tunbridge very stony	15-25%	Well Drained	C	0.6	6.0	0.6	6.0
169B	Sunapee very stony	3-8%	Moderately Well Drained	B	.6	2.0	.6	6.0
299Bcaade	Udorthents	3-8%	Well Drained	Not determined	NA~	NA~	NA~	NA~
299Ccaade	Udorthents	8-15%	Well Drained	Not determined	NA~	NA~	NA~	NA~
299Dcabde	Udorthents	15-25%	Well Drained	Not determined	NA~	NA~	NA~	NA~
299Dcaade	Udorthents	15-25%	Well Drained	Not determined	NA~	NA~	NA~	NA~

350Bdaaab	Udorthents	3-8%	Moderately Well Drained	B**	NA~	NA~	NA~	NA~
395A	Chocorua	0-3%	Very Poorly Drained	D	NA	NA	NA	NA
400Aabaaa	Udorthents	0-3%	Excessively Drained	A**	NA~	NA~	NA~	NA~
400Bbaebc	Udorthents	3-8%	Somewhat Excessively Drained	C**	NA~	NA~	NA~	NA~
400Bbaabb	Udorthents	3-8%	Somewhat Excessively Drained	B**	NA~	NA~	NA~	NA~
400Bcbabb	Udorthents	3-8%	Well Drained	B**	NA~	NA~	NA~	NA~
400Caaaaa	Udorthents	8-15%	Excessively Drained	A**	NA~	NA~	NA~	NA~
400Eaaaaa	Udorthents	25-35%	Excessively Drained	A**	NA~	NA~	NA~	NA~
400Faaaaa	Udorthents	>35%	Excessively Drained	A**	NA~	NA~	NA~	NA~
400Cbaebc	Udorthents	8-15%	Somewhat Excessively Drained	C**	NA~	NA~	NA~	NA~
400Dbaabb	Udorthents	15-25%	Somewhat Excessively Drained	B**	NA~	NA~	NA~	NA~
400Ebaabb	Udorthents	25-35%	Somewhat Excessively Drained	B**	NA~	NA~	NA~	NA~
400Fabaaa	Udorthents	>35%	Excessively Drained	A**	NA~	NA~	NA~	NA~
415B	Moosilauke very stony	3-8%	Poorly Drained	C	6.0	20.0	6.0	20.0
500Cbaebc	Udorthents	8-15%	Somewhat Excessively Drained	C**	NA~	NA~	NA~	NA~
550Dbaded	Udorthents	15-25%	Somewhat Excessively Drained	D**	NA~	NA~	NA~	NA~
550Dbaebc	Udorthents	15-25%	Somewhat Excessively Drained	C**	NA~	NA~	NA~	NA~
699Aabaaa	Urban Land	0-3%	Excessively Drained	A**	NA~	NA~	NA~	NA~
900Afaabc	Udorthents	0-3%		C**	NA~	NA~	NA~	NA~

NA- Not Available * SSSNNE, Publication #5; ** estimated;
~ See disturbed soil mapping unit supplement for estimates
Revised 10/26/13

Mapping Unit Descriptions

See Attachment A for disturbed mapping unit supplemental legend and descriptions.

36C-Adams loamy sand, 8-15% slope

This soil is deep, excessively drained and exists on a sandy terrace. They have loamy sand textures in the upper horizons and sand in the lower horizons Included in this unit are small areas of Colton soils with a gravelly lower horizon.

92B-Lyman very stony, 3-8%

The Lyman soils are gently sloping fine sandy loam tills, shallow, and somewhat excessively drained. Inclusions include occasional outcrops, deep Berkshire soils, and moderately deep Tunbridge soils.

92C-Lyman very stony, 8-15%

The Lyman soils are strongly sloping fine sandy loam tills, shallow, and somewhat excessively drained. Inclusions include occasional outcrops, deep Berkshire soils, and moderately deep Tunbridge soils.

92D-Lyman very stony, 15-25%

The Lyman soils are moderately steep sloping fine sandy loam tills, shallow, and somewhat excessively drained. Inclusions include occasional outcrops, deep Berkshire soils, and moderately deep Tunbridge soils.

92E-Lyman very stony, 25-35%

The Lyman soils are steep sloping fine sandy loam tills, shallow, and somewhat excessively drained. Inclusions include occasional outcrops, deep Berkshire soils, and moderately deep Tunbridge soils.

92F-Lyman very stony, >35%

The Lyman soils are very steep sloping fine sandy loam tills, shallow, and somewhat excessively drained. Inclusions include occasional outcrops, deep Berkshire soils, and moderately deep Tunbridge soils.

99B-Tunbridge very stony, 3 to 8 percent slopes

The gently sloping Tunbridge soils are very fine sandy loam tills, moderately deep, and well drained. Inclusions include occasional outcrops, deep Berkshire soils, and shallow Lyman soils.

99C-Tunbridge very stony, 8 to 15 percent slopes

The strongly sloping Tunbridge soils are very fine sandy loam tills, moderately deep, and well drained. Inclusions include occasional outcrops, deep Berkshire soils, and shallow Lyman soils.

99D-Tunbridge very stony, 15 to 25 percent slopes

The moderately steep sloping Tunbridge soils are very fine sandy loam tills, moderately deep, and well drained. Inclusions include occasional outcrops, deep Berkshire soils, and shallow Lyman soils.

169B-Sunapee soils, 3 to 8 percent slopes, very stony

This soil is very deep, gently sloping or undulating, and moderately well drained. It is on glaciated valleys and hillsides. Typically, the surface and subsurface layers are sandy loam with the substratum loamy sand or sand. Inclusions are nearly level areas of poorly drained Lyme and Moosilauke soils and well drained Monodnock soils.

299B-Udorthents, 3 to 8 percent slopes

This gently sloping, disturbed unit represents areas that are filled with material from grubbing activities (stones, stumps, wood, and soil material) or filled with blasted rock. Mapping units vary in composition and depth of material.

299C-Udorthents, 8 to 15 percent slopes

This strongly sloping, disturbed unit represents areas that are filled with material from grubbing activities (stones, stumps, wood, and soil material) or filled with blasted rock. Mapping units vary in composition and depth of material.

299D-Udorthents, 15 to 25 percent slopes

This moderately steep, disturbed unit represents areas that are filled with material from grubbing activities (stones, stumps, wood, and soil material) or filled with blasted rock. Mapping units vary in composition and depth of material.

395A- Chocorua mucky peat, 0 to 3 percent slopes

These nearly level soils formed in organic deposits and are very poorly drained. Inclusions are the poorly drained Naumberg soils.

350B-Udorthents, 3 to 8 percent slopes

These gently sloping disturbed, excavated soils are sandy and are moderately well drained. They are at the floor of excavated areas.

400B-Udorthents, sandy or gravelly, 3 to 8 percent slope

These gently sloping, well drained, excavated areas originally formed in sandy glacial outwash or coarse textured loose till soils. Inclusions in the excavated areas are shallow to bedrock or well drained Udorthents.

400C-Udorthents, sandy or gravelly, 8 to 15 percent slope

These strongly sloping, well drained, excavated areas originally formed in sandy glacial outwash or coarse textured loose till soils. Inclusions in the excavated areas are shallow to bedrock or moderately well drained Udorthents.

400D-Udorthents, sandy or gravelly, 15 to 25 percent slope

These moderately steep, well drained, excavated areas originally formed in sandy glacial outwash or coarse textured loose till soils. Inclusions in the excavated areas are shallow to bedrock Udorthents.

400E-Udorthents, sandy or gravelly, greater than 35 percent slope

These steep, well drained, excavated areas originally formed in sandy glacial outwash or coarse textured loose till soils. Inclusions in the excavated areas are shallow to bedrock or moderately well drained Udorthents.

400F-Udorthents, sandy or gravelly, greater than 35 percent slope

These very steep sloping, well drained, excavated areas originally formed in sandy glacial outwash or coarse textured loose till soils. Inclusions in the excavated areas are shallow to bedrock or moderately well drained Udorthents.

415B-Moosilauke very stony, 3 to 8 percent slopes

These are poorly drained, gently sloping soils that formed in ablation till. They are sandy in the lower layers. Ainlcude4d in these mapping units are seasonal stream and the very poorly drained Peacham soils. They are hydric soils.

550C-Udorthents, loamy, 8 to 15 percent slopes

These are strongly sloping, well drained disturbed areas that have been excavated and are characterized by 10 to 60 inches of loamy sand, sand or gravel over bedrock. Areas that have been disturbed by cuts and excavations for ski trails characterized by soil textures of sand or sandy loams. Included with this unit are small areas of moderately well drained Udorthents..

550D-Udorthents, loamy, 15 to 25 % slopes

These are moderately steep sloping, well drained disturbed areas that have been excavated and are characterized by 10 to 60 inches of loamy sand, sand or gravel over bedrock. Areas that have been disturbed by cuts and excavations for ski trails characterized by soil textures of sand or sandy loams. Included with this unit are small areas of moderately well drained Udorthents..

699A- Urban Land, 0 to 3 percent slopes

This small mapping unit consists of concrete and transmission line tower.

900A-Endoquents, sandy, 0 to 3 percent slopes

These are disturbed areas where soil material has been excavated down to or near the watertable. Soil material is loamy sand, sand, or gravel. They are hydric soil mapping units.

Prepared by Raymond Lobdell, CSS
12/15/12
Revised 10/26/13

ATTACHMENT A
DISTURBED SOIL MAPPING UNIT SUPPLEMENT
(from "Site Specific Soil Mapping Standards for NH & VT, Version 4.0, SSSNNE)

The five components of the Disturbed Soil Mapping Unit Supplement are as follows:

Symbol 1: Drainage Class
a-Excessively Drained
b-Somewhat Excessively Drained
c-Well Drained
d-Moderately Well Drained
e-Somewhat Poorly Drained
f-Poorly Drained
g-Very Poorly Drained
h-Not Determined

Symbol 2 -: Parent Material (of naturally formed soil only, if present)
a-No natural soil within 60"
b-Glaciofluvial Deposits (outwash/terraces of sand or sand and gravel)
c-Glacial Till Material (active ice)
d-Glaciolacustrine very fine sand and silt deposits (glacial lakes)
e-Loamy/sandy over silt/clay deposits
f-Marine Silt and clay deposits (ocean waters)
g-Alluvial Deposits (floodplains)
h-Organic Materials-Fresh water Bogs, etc
i- Organic Materials-Tidal Marsh

Symbol 3: Restrictive/Impervious Layers
a-None
b-Bouldery surface with more than 15% of the surface covered with boulders
c-Mineral restrictive layer(s) are present in the soil profile less than 40 inches below the soil surface such as hard pan, platy structure or clayey texture with consistence of at least firm, i.e. more than 20 newtons. For other examples of soil characteristics that qualify for restrictive layer, see "Soil Manual for Site evaluations in NH" 2nd Ed., page 3-17, figure 3-14
d-Bedrock in the soil profile 0-20 inches
e-Bedrock in the soil profile 20-60 inches
f-Areas where depth to bedrock is so variable that a single soil type cannot be applied, will be mapped as a complex of soil types
g-Subject to Flooding
h –man-made impervious surface including pavement, concrete, or built-up surfaces (i.e. buildings) with no morphological restrictive layer within control section

Symbol 4 Estimated Ksat* (most limiting layer excluding symbol 3h above).
a- High.
b-Moderate
c-Low
d-Not determined
*See "Guidelines for Ksat Class Placement" in Chapter 3 of the Soil Survey Manual, USDA

Symbol 5: Hydrologic Soil Group*
a-Group A
b-Group B
c-Group C
d-Group D
e-Not determined

*excluding man-made surface impervious/restrictive layers

Site-Specific Soil Survey Report

Wild Meadows Wind Farm
Proposed Operation & Maintenance Facility

prepared for

Horizons Engineering
34 School Street
Littleton, NH 03561

December, 2012

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The purpose of the site specific soil mapping was to comply with NHDES AoT rules. The entire lot was not mapped, only the areas to be disturbed.

Note that portions of the site have been disturbed by farming and land clearing.

Wetlands were delineated and surveyed on to existing conditions plan by others.

Site

The site is located in the northern section of the town of Danbury near the Danbury/Grafton town line, approximately 1000 feet southeast of Grants Pond. The 20 acre site has no direct road frontage but is accessed from Golden Valley Road.

The sloping site is located at elevations ranging from about1342 to 1380 feet above sea level. The site generally slopes to the east and west with an undulating topography with slopes ranging generally from flat to over 35 percent. Soils are glacial till. Land use at the site consists primarily of hayfield surrounded by forest land. Disturbed soil areas on the site include land cleared for agriculture, and small areas of fill including stumps, rocks, and man-made refuse.

Map Legend

Table 1 contains a map legend of the mapping units delineated on the site. The soil mapping units utilize NRCS/NCSS taxonomic class name at the series level with accompanying phase terms. Additionally disturbed units have been delineated using the new 5 symbol Disturbed Mapping Unit Supplement to the Site Specific Soil Mapping Standard for NH and VT (SSSNNE Special Publication #3) shown as "*NRCS Map Symbol/SSSNNE Disturbed Soil Supplement Symbol*" which provides additional information on disturbed units.

Also included in Table 1 are slope groupings, drainage classes, hydrologic groupings and Ksat values.

Table 1
Site-Specific Soil Survey Map Unit Key

Mapping Unit Symbol	Soil Mapping Unit Name	Slope Grouping	Drainage Class	Hydrologic Group	Ksat* low-B (in/hr)	Ksat* high-B (in/hr)	Ksat* low-C (in/hr)	Ksat* high-C (in/hr)
56B	Becket	3-8%	Well Drained	C	0.6	2.0	0.06	0.6
56C	Becket	8-15%	Well Drained	C	0.6	2.0	0.06	0.6
57C	Becket very stony	8-15%	Well Drained	C	0.6	2.0	0.06	0.6
57D	Becket very stony	15-25%	Well Drained	C	0.6	2.0	0.06	0.6
57E	Becket very stony	>25%	Well Drained	C	0.6	2.0	0.06	0.6
299Ccaabc	Udorthents	8-15%	Well Drained	C	NA~	NA~	NA~	NA~
299Cccccc	Udorthents,	8-15%	Well Drained	C	NA~	NA~	NA~	NA~
299Dccccc	Udorthents,	15-25%	Well Drained	C	NA~	NA~	NA~	NA~
299Ccaacc	Udorthents,	8-15%	Well Drained	C	NA~	NA~	NA~	NA~
549B	Peacham	3-8%	Very Poorly Drained	D	0.6	2.0	0.0	0.2
558B	Skerry	3-8%	Moderately Well Drained	C	0.6	2.0	2.0	0.6
559B	Skerry very stony	3-8%	Moderately Well Drained	C	0.6	2.0	2.0	0.6
646B	Pillsbury	3-8%	Poorly Drained	C	0.6	2.0	0.06	0.2
647B	Pillsbury very stony	3-8%	Poorly Drained	C C	0.6	2.0	0.06	0.2
647C	Pillsbury very stony	8-15%	Poorly Drained	C	0.6	2.0	0.06	0.2

NA- Not Available * SSSNNE, Publication #5; ** estimated;
~ See disturbed soil mapping unit supplement for estimates

Mapping Unit Descriptions

See Attachment A for disturbed mapping unit supplemental legend and descriptions.

56B-Becket, 3 to 8 percent slopes

This gently sloping soil is a deep well drained glacial till formed in loamy over sandy dense basal till. Surface stones were removed for agriculture. Included in the unit is the moderately well drained Skerry and areas with no or deep restrictive layers.

56C-Becket, 8 to 15 percent slopes

This strongly sloping soil is a deep well drained glacial till formed in loamy over sandy dense basal till. Surface stones were removed for agriculture. Included in the unit is the moderately well drained Skerry and areas with no or deep restrictive layers.

57C-Becket very stony, 8 to 15 percent slopes

This strongly sloping soil is a deep well drained glacial till formed in loamy over sandy dense basal till. While this unit is in agriculture the tops of buried stones and boulders are present. The unit includes Udorthents filled with stone and soil for grubbing.

57D-Becket very stony, 15 to 25 percent slopes

This moderately steep sloping soil is a deep well drained glacial till formed in loamy over sandy dense basal till. Surface stones were removed for agriculture. Included in the unit is the moderately well drained Skerry and areas with no or deep restrictive layers.

57E-Becket very stony, >25 8 percent slopes

This steep sloping soil is a deep well drained glacial till formed in loamy over sandy dense basal till. Surface stones are present. Included in the unit is the moderately well drained Skerry and areas with no or deep restrictive layers.

299C-Udorthents

This disturbed unit represents strongly sloping areas that are filled with of material from grubbing activities on-site and consist of stones, sandy loam material, stumps, and wood debris.

299D-Udorthents

This disturbed unit represents steep sloping areas that are filled with of material from grubbing activities (stones, stumps, wood, and soil material) as well metal and other refuse.

549B-Peacham very stony

These gently sloping, very deep, very poorly drained soils are on glaciated low areas. The Peacham soils are typically small areas in depressions and along drainage ways. Slopes range from 3 to 8 percent. Surface stones are present. Included in these mapping units are small areas of poorly drained Pillsbury soils.

558B- Skerry, 3 to 8 percent slopes

This gently sloping soil is a deep, moderately well drained glacial till formed in loamy over sandy dense basal till. Surface stones were removed for agriculture. Included in the unit is the well drained Becket and soil areas with no or deep restrictive layers.

559B- Skerry, 3 to 8 percent slopes

This gently sloping soil is a deep, moderately well drained soil formed in loamy over sandy dense basal till. Surface stones are present. Included in the unit is the well drained Becket soil and areas with no or deep restrictive layers.

646B-Pillsbury, 3 to 8% slopes

These very deep, poorly drained soils are on glaciated low areas. Surface stones have been removed for agriculture. They are hydric soil mapping units. Included in mapping are small or narrow areas of Peacham and Skerry soils.

647B-Pillsbury very stony, 3 to 8 percent slopes

These very deep, poorly drained soils are on glaciated upland low areas. Surface stones are present of the surface. The units may contain seasonal streams. They are hydric soil mapping units. Included in mapping are small or narrow areas of Peacham and Skerry soils.

647C-Pillsbury very stony, 8 to 15 percent slopes

These very deep, poorly drained soils are on glaciated upland low areas. Surface stones are present of the surface. The units may contain seasonal streams. They are hydric soil mapping units. Included in mapping are small or narrow areas of Peacham and Skerry soils.

Prepared by Raymond Lobdell, CSS
Revised 10/25/13

ATTACHMENT A
DISTURBED SOIL MAPPING UNIT SUPPLEMENT
(from "Site Specific Soil Mapping Standards for NH & VT, Version 4.0, SSSNNE)

The five components of the Disturbed Soil Mapping Unit Supplement are as follows:

Symbol 1: Drainage Class
a-Excessively Drained
b-Somewhat Excessively Drained
c-Well Drained
d-Moderately Well Drained
e-Somewhat Poorly Drained
f-Poorly Drained
g-Very Poorly Drained
h-Not Determined

Symbol 2 -: Parent Material (of naturally formed soil only, if present)
a-No natural soil within 60"
b-Glaciofluvial Deposits (outwash/terraces of sand or sand and gravel)
c-Glacial Till Material (active ice)
d-Glaciolacustrine very fine sand and silt deposits (glacial lakes)
e-Loamy/sandy over silt/clay deposits
f-Marine Silt and clay deposits (ocean waters)
g-Alluvial Deposits (floodplains)
h-Organic Materials-Fresh water Bogs, etc
i- Organic Materials-Tidal Marsh

Symbol 3: Restrictive/Impervious Layers
a-None
b-Bouldery surface with more than 15% of the surface covered with boulders
c-Mineral restrictive layer(s) are present in the soil profile less than 40 inches below the soil surface such as hard pan, platy structure or clayey texture with consistence of at least firm, i.e. more than 20 newtons. For other examples of soil characteristics that qualify for restrictive layer, see "Soil Manual for Site evaluations in NH" 2nd Ed., page 3-17, figure 3-14
d-Bedrock in the soil profile 0-20 inches
e-Bedrock in the soil profile 20-60 inches
f-Areas where depth to bedrock is so variable that a single soil type cannot be applied, will be mapped as a complex of soil types
g-Subject to Flooding
h –man-made impervious surface including pavement, concrete, or built-up surfaces (i.e. buildings) with no morphological restrictive layer within control section

Symbol 4 Estimated Ksat* (most limiting layer excluding symbol 3h above).
a- High.
b-Moderate
c-Low
d-Not determined
*See "Guidelines for Ksat Class Placement" in Chapter 3 of the Soil Survey Manual, USDA

Symbol 5: Hydrologic Soil Group*
a-Group A
b-Group B
c-Group C
d-Group D
e-Not determined

*excluding man-made surface impervious/restrictive layers

3.7 Infiltration Feasibility Report

INFILTRATION FEASIBILITY REPORT
FOR ATLANTIC WIND, LLC
WILD MEADOWS WIND PROJECT OPERATIONS AND MAINTENANCE AREA
DANBURY, NEW HAMPSHIRE

NOVEMBER 2013

TABLE OF CONTENTS

PROJECT NO. 13185

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I. LOCATION OF THE PRACTICES

Filtration Pond – P – This pond is located approximately 500 feet southeast of Grant's Pond, adjacent to Golden Valley Road, and across the proposed site access road from the Operations and Maintenance area.

II. EXISTING TOPOGRAPHY AT THE PRACTICE LOCATION

Filtration Pond – P – The pond is located in a relatively flat cleared area between two existing wooded wetlands. The land generally slopes to the northwest toward Grant's Pond at approximately 4%.

III. TEST PIT LOCATIONS

Filtration Pond – P – The proposed pond has a bottom area of approximately 2,445 square feet, requiring one test pit. A test pit was dug near the center of the proposed pond to confirm depth to bedrock and E.S.H.W.T. This test pit is identified as TP#1. The E.S.H.W.T. was encountered at a depth of 24", at an elevation of approximately 1350.1ft. Ledge was not encountered to a depth of 60", and is thus assumed to be located at the bottom of the test pit, an elevation of 1347.1ft.

Additionally, a borehole infiltration test was conducted in the bottom of the proposed pond. This has been identified as INF.

IV. GRADING PLANS (SEE ATTACHED)

V. SEASONAL HIGH WATER AND BEDROCK ELEVATIONS

Filtration Pond – P – TP#1

The elevation at which the pit was dug = 1352.0
E.S.H.W.T. was found at 24" = 1350.0
Bedrock not found, assumed at pit bottom = 1347.0
Pit bottom at 60" = 1347.0

The bottom of the practice has been set at elev. 1353.0

VI. PROFILE DESCRIPTIONS (SEE ATTACHED)

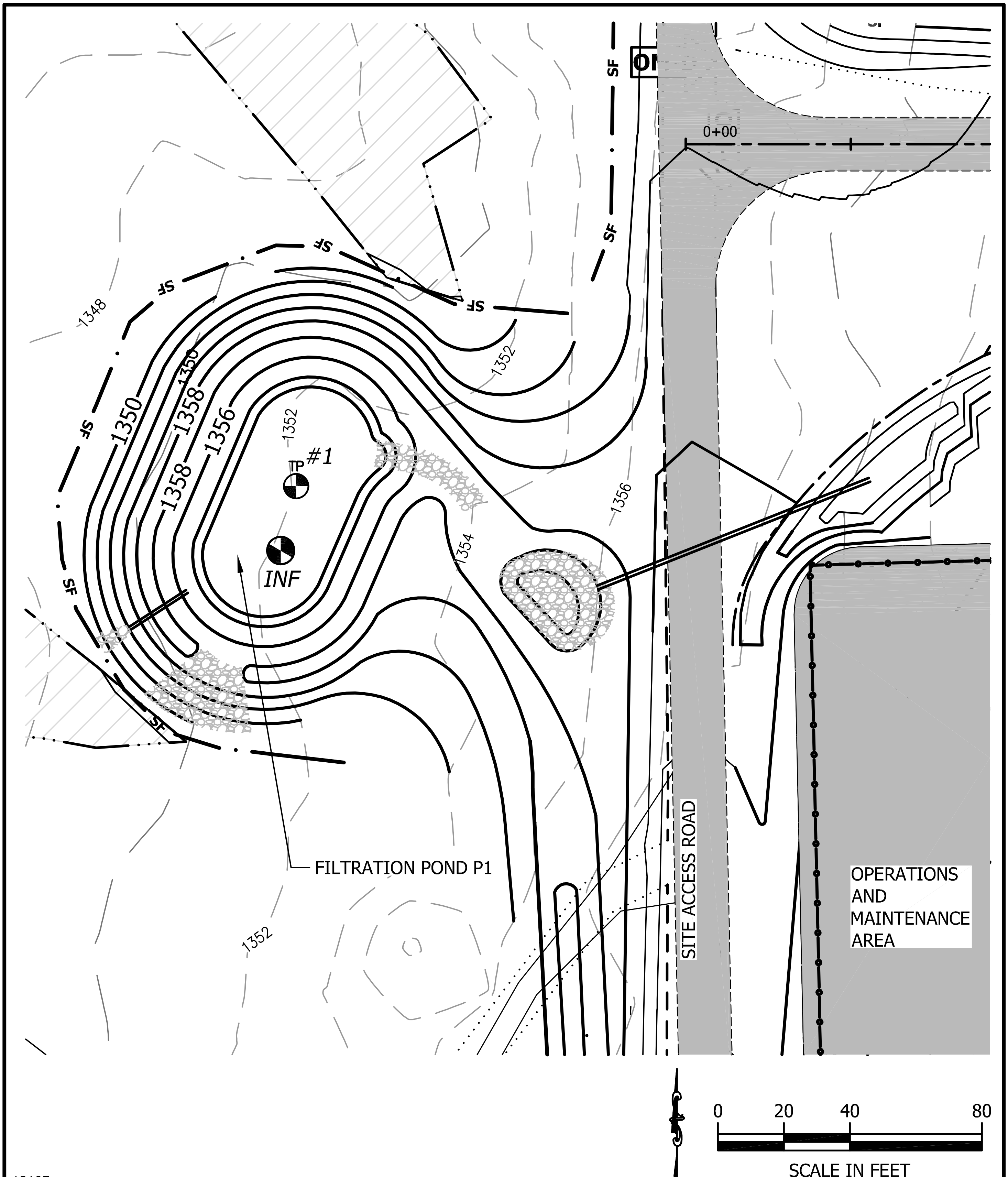
VII. DESIGN INFILTRATION RATE

Filtration Pond – P – The infiltration rate was determined using the Field Measurement method described in Env-Wq 1504.14 (e) (4).

The Ksat was measured at TP#1 using the Borehole method.

The Ksat value of the last repetition was 37.60 inches per hour.

The field measured Ksat value exceeds that allowed by rule, and soil amendment will be needed to reduce the rate of infiltration. This amendment should be designed by a qualified geotechnical engineer to reduce the infiltration rate to 5.0 inches per hour, or use the sand filter media as shown on the design plans as specified in the NHDES Stormwater Management Manual, Volume 2, Table 4-3 Filter Mixtures. After applying a factor of safety, the design rate used in the drainage analysis is 2.5 inches per hour.



13185

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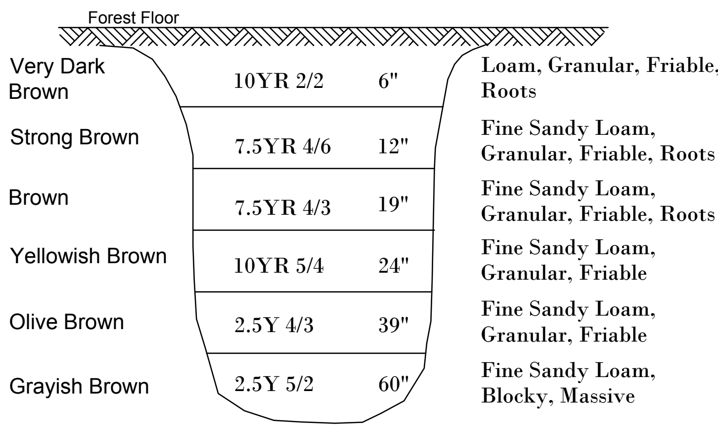
WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

IV. GRADING PLAN

OPERATIONS AND MAINTENANCE FACILITY
TEST PIT #1



E.S.H.W.T.: 24"
WATER OBSERVED: 60"
LEDGE ENCOUNTERED: None
RESTRICTIVE LAYER: 26"

INSPECTED BY: J. Daigneault
DATE: 10/7/13

SOILS TYPE: 647B - Pillsbury, Fine Sandy Loam

13185

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

VI. PROFILE DESCRIPTION

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INFILTRATION FEASIBILITY REPORT
FOR ATLANTIC WIND, LLC
WILD MEADOWS WIND PROJECT ELECTRICAL SUBSTATION
ALEXANDRIA, NEW HAMPSHIRE

NOVEMBER 2013

TABLE OF CONTENTS

PROJECT NO. 13185

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I. LOCATION OF THE PRACTICE
Filtration Pond – INF1 – This pond is located in southwest of the substation area, adjacent to the substation pad and the gravel access road. At present, a gravel drive passes through a portion of the proposed pond area. A portion of the proposed pond lies within the tree line. Much of the nearby area has been used as a gravel pit.

II. EXISTING TOPOGRAPHY AT THE PRACTICE LOCATION
Filtration Pond – INF1 – Topography in the area of the proposed pond gently slopes from west to east at roughly 15%.

III. TEST PIT LOCATIONS
Filtration Pond – INF 1 is approximately 2,455 square feet in bottom area. A test pit, identified as TP-1 was dug in the middle of the proposed pond to confirm depth to bedrock and E.S.H.W.T. The E.S.H.W.T. was not found, however ledge was encountered at a depth of 30”, an elevation of approximately 628.7 feet. E.S.H.W.T. is assumed to be located at the bottom of the test pit, where ledge was encountered.

A borehole infiltration test, identified as INF, was also conducted in the bottom of this practice, approximately 20 north of TP-1**.**

IV. GRADING PLAN (SEE ATTACHED)

V. SEASONAL HIGH WATER AND BEDROCK ELEVATION
Filtration Pond – INF 1

TP-1
The elevation at which the pit was dug = 631.2
Pit bottom at 30” = 628.7
Bedrock at 30” = 628.7
E.S.H.W.T. was not found therefore = 628.7

The bottom of the practice has been set at elev. 632.25, confirming more than 3’ of separation to E.S.H.W.T.

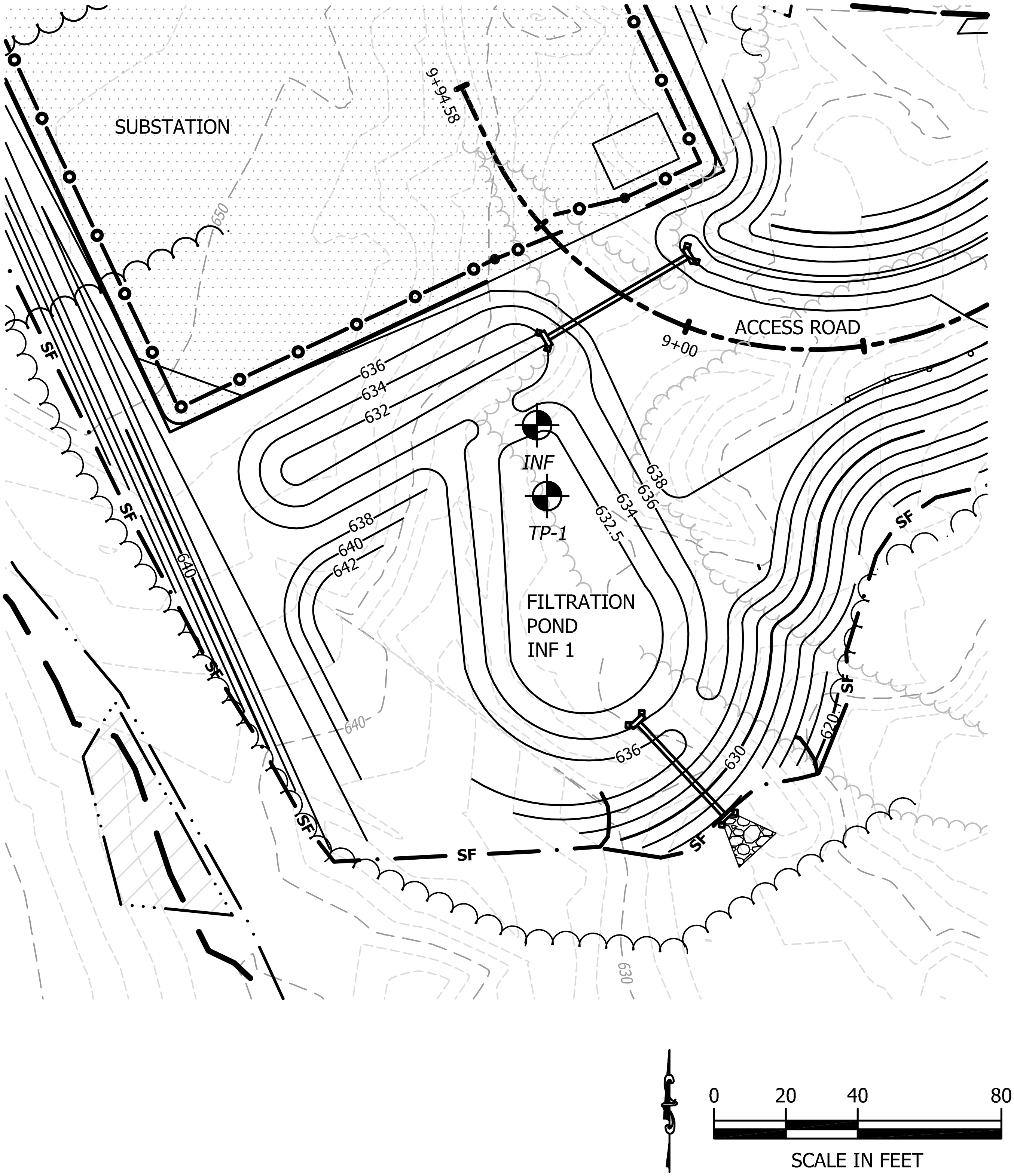
VI. PROFILE DESCRIPTION (SEE ATTACHED)

VII. DESIGN INFILTRATION RATE
Filtration Pond—INF 1 – The infiltration rate was determined using the Field Measurement method described in Env-Wq 1504.14 (e) (4).

The Ksat was measured at INF using the Borehole method.

The Ksat value of the last repetition was 319.2 inches per hour.

The field measured Ksat value exceeds that allowed by rule, and soil amendment will be needed to reduce the rate of infiltration. This amendment should be designed by a qualified geotechnical engineer to reduce the infiltration rate to 5.0 inches per hour, or use the sand filter media as shown on the design plans as specified in the NHDES Stormwater Management Manual, Volume 2, Table 4-3 Filter Mixtures. After applying a factor of safety, the design rate used in the drainage analysis is 2.5 inches per hour.



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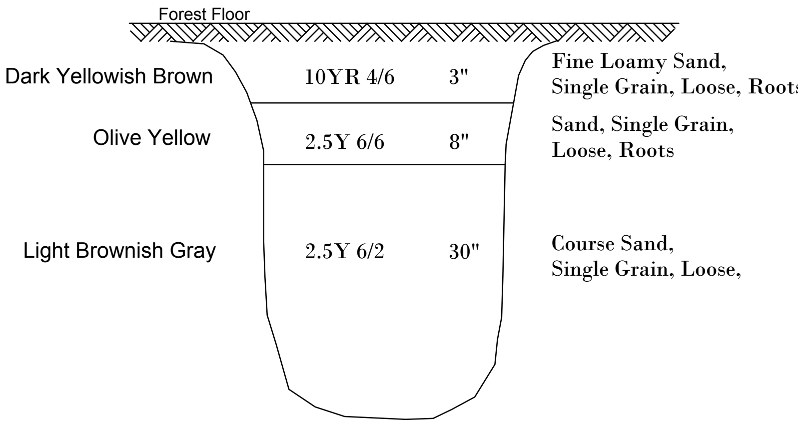
WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

IV. GRADING PLAN

SUBSTATION MAINTENANCE FACILITY
TEST PIT #1



E.S.H.W.T.: None Observed
WATER OBSERVED: None Observed
LEDGE ENCOUNTERED: Refusal at 30"

INSPECTED BY: J. Daigneault
DATE: 10/7/13

SOILS TYPE: 90C - Tunbridge-Lyman Complex

13185

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

VI. PROFILE DESCRIPTION

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3.8 Inspection and Maintenance Manual

Inspection and Maintenance (I&M) Plan

For

Stormwater Management Devices
Wild Meadows Wind Project
Atlantic Wind, LLC

Introduction

This document is intended to provide a unified procedure for the party(s) responsible for inspecting and maintaining the various stormwater management devices that were installed as part of the development of the Wild Meadows Wind Project (see attached Location Plan for the device locations and design sheets for applicable culvert locations). The activities specified in this plan are required for continued compliance with the New Hampshire Department of Environmental Services (DES) Alteration of Terrain Program and associated permit that has been issued for the Wild Meadows Wind Project.

Inspection Forms and Logs included at the end of this document are intended to be reproduced, used, and kept with this Plan as a record of activities.

Responsible Parties

The ultimate responsibility for complying with this plan rests with the leaseholders of the Property, even if another entity provides inspection and maintenance services.

Leaseholders Name: **Atlantic Wind, LLC**

Prior to transfer of ownership to another entity, both parties shall notify DES in writing of such transfer.

Parties assigned to complete inspection, maintenance, and reporting tasks are presented in the following table.

Locations

All new stormwater management devices installed as part of the project shall be inspected and maintained. Stormwater management devices are shown on the Table of Stormwater Management Devices. In the table, Stationing and Plan Sheet numbers refer to Horizons Engineering, Inc. *Permitting* Plan set, November 2013.

Table of Stormwater Management Devices

Device	Location	Sheet #	Task	Party
Infiltration Devices				
Substation Infiltration Pond, INF1	Substation Area	C9.1	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Operations and Maintenance Filtration Pond	Operations and Maintenance Area	C3.2	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Conveyance Structures				
Treatment Swale (TS-CEC-1.0)	Central East Connector Road 32+00	C7.4	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-CEC-2.0)	Central East Connector Road 35+00	C7.4	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-CEC-3.0)	Central East Connector Road 38+50	C7.5	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-CEC-4.0)	Central East Connector Road 45+75	C7.5	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-CEC-5.0)	Central East Connector Road 52+00	C7.5	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-ECAS-1.0)	East Crane South 27+25	C8.2	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-ECAS-2.0)	East Crane South 38+00	C8.2	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-ECAS-3.0)	East Crane South 51+25	C7.7	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-CCS-1.0)	Central Crane South 1+60	C3.2	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-CCN-1.0)	Central Crane North 14+00	C6.1	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-CCN-2.0)	Central Crane North 32+40	C6.2	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS1)	Substation Access Road 1+75	C9.1	Inspection Maintenance Reporting	ATLANTIC WIND, LLC

Device	Location	Sheet #	Task	Party
Conveyance Structures				
Treatment Swale (TS-AC-1.0)	Site Access Road 5+50	C2.1	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Treatment Swale (TS-AC-2.0)	Site Access Road 18+00	C2.2	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Level Lip Spreader	Central Crane South 79+25, Near C-3	C5.4	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Level Lip Spreader	Central Crane North 10+00, Near N-1	C6.1	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Level Lip Spreader	G-2 Crane 14+60, Near G-2	C7.3	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Level Lip Spreader	East Crane South 31+25, Near E-3	C8.2	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Detention Structures				
Sediment Traps	Various, throughout project site	Varies	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Sedimentation Pond	Operations and Maintenance Area	C3.1	Inspection Maintenance Reporting	ATLANTIC WIND, LLC
Substation Micropool Extended Detention Pond, MP1	Substation Area	C9.1	Inspection Maintenance Reporting	ATLANTIC WIND, LLC

Frequency of Activities

Inspection and Maintenance of all stormwater devices in the wind project and associated infrastructure should begin as soon as each practice is constructed and stabilized and must continue as long as each device is in place.

The best time to perform inspections is during the onset of rain. To the extent practicable inspections should be timed to coincide with moderate storms that do not have the potential for severe (thunderstorms, high winds, etc) weather. The frequency of inspection and maintenance will vary by device and its intensity of use; however the following shall serve as the minimum inspection frequency:

- Infiltration Devices: Spring and fall
- Conveyance Structures (treatment swales, level lip spreaders): Spring and fall
- Detention Structures (detention ponds, sedimentation ponds, sediment traps): Spring and fall

Maintenance frequencies will be determined based upon the results of the inspections and if specific maintenance thresholds are observed during inspections to have been crossed.

All inspection activities shall be recorded on the appropriate attached Inspection Forms. One form shall be used for each stormwater device.

Disposal of Materials

Material that is removed during the maintenance of stormwater treatment devices should be placed in an upland area that will minimize the potential for the material to be entrained in stormwater or otherwise re-enter surface waters or wetlands.

Records

A record of inspection and maintenance activities of stormwater treatment devices shall be recorded on the Inspection and Maintenance Log and Inspection Forms. Records of Inspection and Maintenance Logs, and Inspection Forms shall be provided to DES within 30 days of such a request.

Invasive Species Control

Invasive (non-native) plant species must not be allowed to grow in stormwater devices. Visual inspection for invasive species should be done at the same time as other inspections. As an aid to identification of land-based invasive species, the "Guide to Invasive Upland Plant Species in New Hampshire" is published by the New Hampshire Department of Agriculture, Markets and Food, Plant Industry Division and the New Hampshire Invasive Species Committee, available on the internet at: http://www.agriculture.nh.gov/divisions/plant_industry/documents/invasive-species.pdf

The New Hampshire Department of Environmental Services Waters Division has information related to water-dwelling invasive species available at the following website:
http://des.nh.gov/organization/divisions/water/wmb/exoticspecies/index.htm
Other resources are available through state agencies and the extension office.

Each identified invasive species should be destroyed by the most effective method recommended in the resource materials including pulling, cutting, or digging, then disposed of safely.

Effective control of invasives depends on detection when infestations are small and easily managed.

____
Year

Stormwater BMP
Inspection and Maintenance Log

Wild Meadows Wind Project

DEVICE/ LOCATION	INSPECTION		FOLLOW UP ACTIVITY	
	Date	Inspector Name	Date	Action Taken

____________________ BMP Name

Infiltration Devices
Infiltration / Surface Sand Filtration Pond
Inspection Form

Wild Meadows Wind Project

Date of today's inspection___/___/___ Inspector Name________________________
Date of last inspection (of this BMP) ___/___/___

Recent Weather history

Storm date(s)	Storm duration	Rainfall amount	Did runoff occur?

Today's Weather________________

INSPECTION AREAS	LOOK FOR	CIRCLE ONE		IF YES
Outlet(s) from BMP				
	Spillway scour?	Y	N	Replace scour apron to original plan dimensions, may need to increase D_{50} stone size
	Clogged pipe/weir	Y	N	Remove clog and debris in vicinity of outlet
	Seepage through berm	Y	N	Attempt to find source with dye and plug with bentonite or appropriate low permeability materials
Banks				
	Erosion?	Y	N	Reshape, seed and apply erosion control matting
	Large areas of sparse growth above waterline?	Y	N	Take soil sample and apply slow release amendments(N, K) per results
	Bank settling or gullies forming?	Y	N	Fill void or gullies with specified material, compact, and vegetate
	Woody growth on berms?	Y	N	Remove woody growth, mow/cut more frequently
Device Floor				
	Sediment accumulations?	Y	N	Rake or shovel out accumulated sediment.

Device Floor				
	Filter Media failure?	Y	N	Replace per manufacturer's specifications
	Does system drain in 72 hours?	Y	N	Seek a qualified professional to assess the condition to determine measures required to restore filtration function, including but not limited to removal of accumulated sediments or reconstruction of the filter.
Inlet(s) to BMP				
	Scour?	Y	N	Replace scour apron to original plan dimensions, may need to increase D_{50} stone size and/ or add check dam
	Sediment accumulation?	Y	N	Inspect upstream devices and landscape to determine source and stabilize. Remove sediment accumulation.
Invasive Species				
	Non-native plants growing on land surfaces?	Y	N	Confirm species, carefully destroy and dispose of plants. Re-inspect within one growing season.
	Non-native plants growing in water?	Y	N	Confirm species, carefully destroy and dispose of plants. Re-inspect within one growing season.

________________ BMP Name

Conveyance Structures
Level Lip Spreaders / Treatment Swales
Inspection Form

Wild Meadows Wind Project

Date of today's inspection___/___/___   Inspector Name________________________
Date of last inspection (of this BMP) ___/___/___

Recent Weather history

Storm date(s)	Storm duration	Rainfall amount	Did runoff occur?

Today's Weather________________

INSPECTION AREAS	LOOK FOR	CIRCLE ONE		IF YES
Outlet(s) from BMP				
	Turbid Discharge?	Y	N	Follow turbidity upgradient to source and stabilize
	Rills present or crest not level?	Y	N	Patch/grade to ensure discharge is not concentrated and re-vegetate.
Banks				
	Erosion?	Y	N	Reshape, seed and apply erosion control matting
Device Floor				
	Sediment accumulations?	Y	N	Inspect upstream devices and landscape to determine source and stabilize. Rake or shovel out when sediment is within 1' of Sediment Trap outlet weir elevation or is 2" deep for Treatment Swales.
	Area of organic mat exceeds area of living vegetation?	Y	N	Hand rake, scarify, or aerate.
	Woody growth in treatment swale?	Y	N	Cut at least annually to a height of 4"

Invasive Species				
	Non-native plants growing on land surfaces?	Y	N	Confirm species, carefully destroy and dispose of plants. Re-inspect within one growing season.
	Non-native plants growing in water?	Y	N	Confirm species, carefully destroy and dispose of plants. Re-inspect within one growing season.

____
BMP Name

Detention Structures
Detention Ponds / Sediment Basins / Sediment Traps
Inspection Form

Wild Meadows Wind Project

Date of today's inspection___/___/___ Inspector Name________________________
Date of last inspection (of this BMP) ___/___/___

Recent Weather history

Storm date(s)	Storm duration	Rainfall amount	Did runoff occur?

Today's Weather________________

INSPECTION AREAS	LOOK FOR	CIRCLE ONE		IF YES
Outlet(s) from BMP				
	Turbid Discharge?	Y	N	Follow turbidity upgradient to source and stabilize
	Scour?	Y	N	Replace scour apron to original plan dimensions, may need to increase D_{50} stone size
	Clogged pipe/weir	Y	N	Remove clog and debris in vicinity of outlet
	Seepage through berm	Y	N	Attempt to find source with dye and plug with bentonite or appropriate low permeability materials
Banks				
	Erosion?	Y	N	Reshape, seed and apply erosion control matting
	Large areas of sparse growth above waterline?	Y	N	Take soil sample and apply slow release amendments(N, K) per results
	Large areas below waterline are slumping?	Y	N	Either establish appropriate wetland vegetation or apply stone
	Bank settling or gullies forming?	Y	N	Fill void or gullies with specified material, compact, and vegetate
	Woody growth	Y	N	Remove woody growth, mow/cut

	on berms ?			more frequently
Device Floor				
	Sediment accumulations?	Y	N	Rake or shovel out excess sediment (i.e. when sediment is within 1' of Sediment Trap outlet weir elevation)
	Area of organic mat exceeds area of living vegetation?	Y	N	Hand rake, scarify, or aerate.
Inlet(s) to BMP				
	Scour?	Y	N	Replace scour apron to original plan dimensions, may need to increase D_{50} stone size and/ or add check dam
	Sediment accumulation?	Y	N	Inspect upstream devices and landscape to determine source and stabilize. Remove sediment accumulation.
Invasive Species				
	Non-native plants growing on land surfaces?	Y	N	Confirm species, carefully destroy and dispose of plants. Re-inspect within one growing season.
	Non-native plants growing in water?	Y	N	Confirm species, carefully destroy and dispose of plants. Re-inspect within one growing season.

3.9 Request to Expedite Permit – Waiver Request – N/A

3.10 References
Preparer's Certification
Reviewer's Certification

REFERENCES

Mays, Larry. *Stormwater Collection Systems Design Handbook*. McGraw-Hill. New York, NY. 2001

McCarthy, David. *Essentials of Soil Mechanics and Foundations: Sixth Edition*. Prentice Hall. Columbus, Ohio. 2002.

NHDES. *New Hampshire Stormwater Manual*. New Hampshire Department of Environmental Services. 2008.

The UNH Stormwater Center, *The LID Stormwater Management Systems Demonstrate LID Stormwater Management Systems Demonstrate Superior Cold Climate Performance than Superior Cold Climate Performance than Conventional Stormwater Management Systems,* *UNH Stormwater Center, NEIWPCC 2007 NPS Conference, Newport, RI, May 2007*

PREPARER'S CERTIFICATION

Prepared by Justin Daigneault

REVIEWER'S CERTIFICATION

Reviewed by Arthur Colvin, P.E.

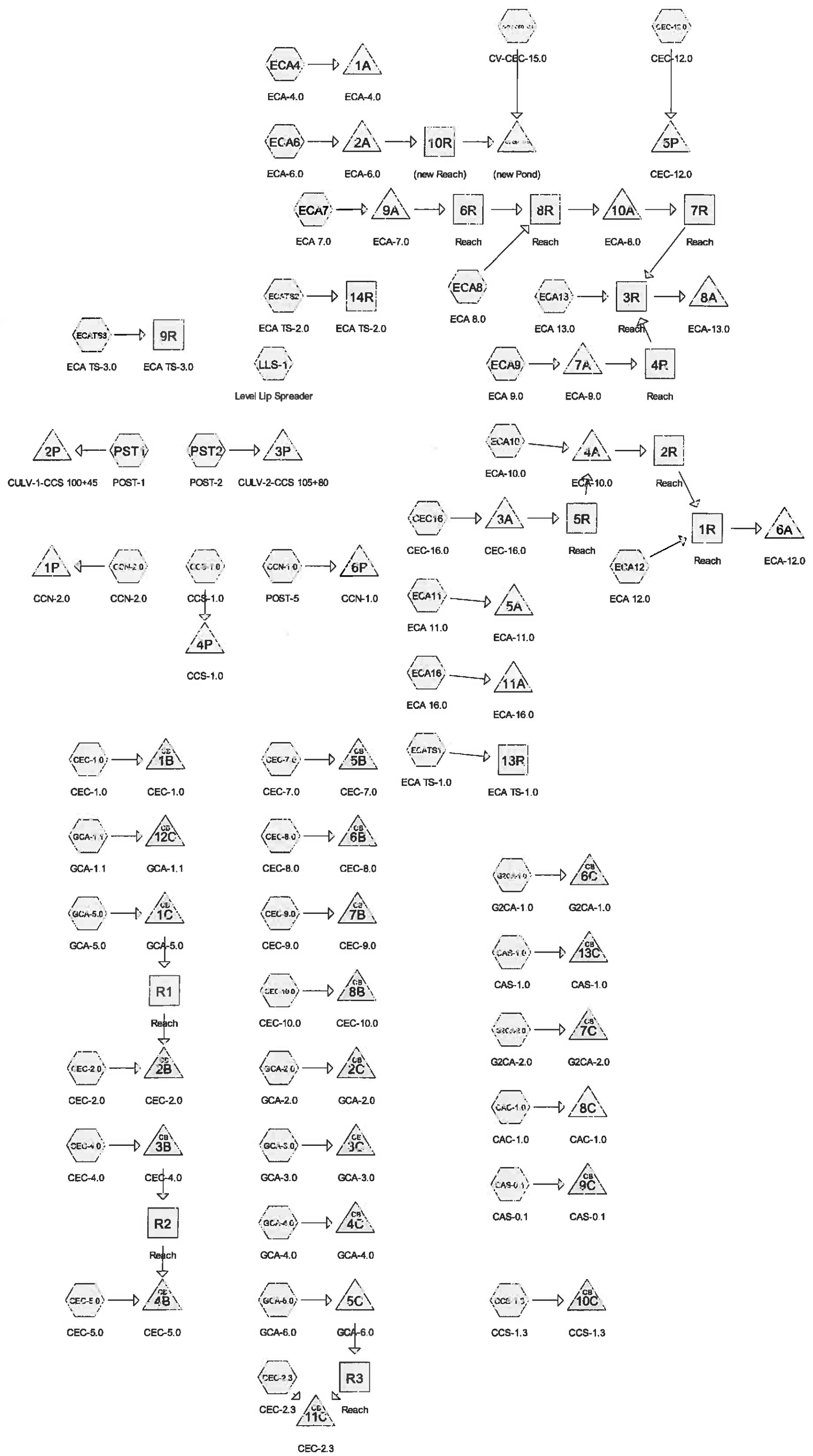
STATE OF NEW HAMPSHIRE
ARTHUR
JOHN
COLVIN
No. 13[illegible]28
LICENSED
PROFESSIONAL ENGINEER

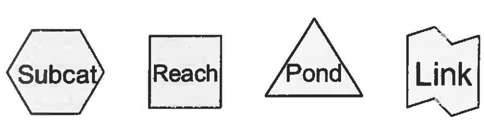
12/4/13

APPENDICES

Supporting Data

Culvert and Level Spreader Sizing





Routing Diagram for Drainage-ALL_Culverts
Prepared by Microsoft, Printed 11/7/2013
HydroCAD® 10.00 s/n 02765 © 2013 HydroCAD Software Solutions LLC

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	CAS-1.0	0.00	0.00	64.0	0.0310	0.015	15.0	0.0	0.0
2	CCS-1.3	0.00	0.00	69.0	0.0140	0.015	15.0	0.0	0.0
3	CEC-1.0	0.00	0.00	50.0	0.0200	0.015	15.0	0.0	0.0
4	CEC-2.0	0.00	0.00	55.0	0.0200	0.015	15.0	0.0	0.0
5	1A	2,109.50	2,107.00	68.0	0.0368	0.015	15.0	0.0	0.0
6	1B	2,101.50	2,084.34	64.0	0.2681	0.015	15.0	0.0	0.0
7	1C	2,149.75	2,147.00	63.0	0.0437	0.015	15.0	0.0	0.0
8	1P	2,046.00	2,042.00	83.0	0.0482	0.015	15.0	0.0	0.0
9	2A	2,025.00	2,017.00	140.0	0.0571	0.015	15.0	0.0	0.0
10	2B	2,093.00	2,089.00	53.0	0.0755	0.015	15.0	0.0	0.0
11	2C	2,192.50	2,187.00	60.0	0.0917	0.015	15.0	0.0	0.0
12	2P	2,197.00	2,196.00	75.0	0.0133	0.015	15.0	0.0	0.0
13	3A	2,005.00	1,993.00	94.0	0.1277	0.015	15.0	0.0	0.0
14	3B	1,885.00	1,881.00	42.0	0.0952	0.015	15.0	0.0	0.0
15	3C	2,145.50	2,135.50	74.0	0.1351	0.015	18.0	0.0	0.0
16	3P	2,156.00	2,155.60	75.0	0.0053	0.015	15.0	0.0	0.0
17	4A	1,855.25	1,845.00	90.0	0.1139	0.015	24.0	0.0	0.0
18	4B	1,859.75	1,848.04	135.0	0.0867	0.015	15.0	0.0	0.0
19	4C	2,136.50	2,125.00	110.0	0.1045	0.015	18.0	0.0	0.0
20	4P	1,627.00	1,607.00	150.0	0.1333	0.015	15.0	0.0	0.0
21	5A	1,787.75	1,761.00	135.0	0.1981	0.015	15.0	0.0	0.0
22	5B	1,849.00	1,839.00	58.0	0.1724	0.015	15.0	0.0	0.0
23	5C	2,127.00	2,125.00	90.0	0.0222	0.015	18.0	0.0	0.0
24	6A	1,780.25	1,757.00	106.0	0.2193	0.015	24.0	0.0	0.0
25	6B	1,801.50	1,801.00	42.0	0.0119	0.015	15.0	0.0	0.0
26	6C	2,101.00	2,099.00	60.0	0.0333	0.015	15.0	0.0	0.0
27	6P	2,086.50	2,085.00	56.0	0.0268	0.015	18.0	0.0	0.0
28	7A	1,872.00	1,845.00	119.0	0.2269	0.015	15.0	0.0	0.0
29	7B	1,811.00	1,805.00	46.0	0.1304	0.015	15.0	0.0	0.0
30	7C	2,095.73	2,094.75	91.0	0.0108	0.015	15.0	0.0	0.0
31	8A	1,765.00	1,748.00	102.0	0.1667	0.015	24.0	0.0	0.0
32	8B	1,829.75	1,825.00	48.0	0.0990	0.015	15.0	0.0	0.0
33	8C	1,366.00	1,365.80	52.0	0.0038	0.015	24.0	0.0	0.0
34	9A	1,969.00	1,963.00	104.0	0.0577	0.015	15.0	0.0	0.0
35	9C	1,451.60	1,442.40	86.0	0.1070	0.015	15.0	0.0	0.0
36	10A	1,875.75	1,870.00	78.0	0.0737	0.015	18.0	0.0	0.0
37	10C	1,451.50	1,451.00	56.0	0.0089	0.015	18.0	0.0	0.0
38	11A	1,665.00	1,652.00	95.0	0.1368	0.015	15.0	0.0	0.0
39	11C	1,974.50	1,960.00	53.0	0.2736	0.015	18.0	0.0	0.0
40	12C	2,206.50	2,206.00	56.0	0.0089	0.015	18.0	0.0	0.0
41	13C	1,460.00	1,455.50	75.0	0.0600	0.015	24.0	0.0	0.0

Time span=5.00-39.95 hrs, dt=0.05 hrs, 700 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A-CV-CEC-15.0: CV-CEC-15.0 Runoff Area=2.339 ac 0.00% Impervious Runoff Depth=2.84"
Tc=0.0 min CN=74 Runoff=9.0 cfs 0.554 af

Subcatchment CAC-1.0: CAC-1.0 Runoff Area=16.930 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=2,088' Tc=35.6 min CN=71 Runoff=26.3 cfs 3.629 af

Subcatchment CAS-0.1: CAS-0.1 Runoff Area=1.566 ac 0.00% Impervious Runoff Depth=2.75"
Flow Length=402' Tc=12.7 min CN=73 Runoff=4.0 cfs 0.359 af

Subcatchment CAS-1.0: CAS-1.0 Runoff Area=8.540 ac 0.00% Impervious Runoff Depth=2.66"
Flow Length=1,415' Tc=15.6 min CN=72 Runoff=19.7 cfs 1.894 af

Subcatchment CCN-1.0: POST-5 Runoff Area=5.822 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=565' Tc=20.0 min CN=71 Runoff=11.7 cfs 1.248 af

Subcatchment CCN-2.0: CCN-2.0 Runoff Area=7.130 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=815' Tc=21.9 min CN=71 Runoff=13.8 cfs 1.528 af

Subcatchment CCS-1.0: CCS-1.0 Runoff Area=4.031 ac 0.00% Impervious Runoff Depth=3.12"
Flow Length=440' Tc=13.4 min CN=77 Runoff=11.6 cfs 1.049 af

Subcatchment CCS-1.3: CCS-1.3 Runoff Area=10.761 ac 0.00% Impervious Runoff Depth=3.03"
Flow Length=2,056' Tc=23.2 min CN=76 Runoff=24.2 cfs 2.716 af

Subcatchment CEC-1.0: CEC-1.0 Runoff Area=1.983 ac 0.00% Impervious Runoff Depth=3.22"
Flow Length=754' Tc=14.1 min CN=78 Runoff=5.8 cfs 0.532 af

Subcatchment CEC-10.0: CEC-10.0 Runoff Area=2.721 ac 0.00% Impervious Runoff Depth=2.06"
Flow Length=687' Tc=17.7 min CN=65 Runoff=4.5 cfs 0.467 af

Subcatchment CEC-12.0: CEC-12.0 Runoff Area=141,273 sf 0.00% Impervious Runoff Depth=2.48"
Flow Length=1,060' Tc=22.4 min CN=70 Runoff=6.0 cfs 0.671 af

Subcatchment CEC-2.0: CEC-2.0 Runoff Area=1.362 ac 0.00% Impervious Runoff Depth=3.32"
Flow Length=723' Tc=14.0 min CN=79 Runoff=4.1 cfs 0.376 af

Subcatchment CEC-2.3: CEC-2.3 Runoff Area=1.362 ac 0.00% Impervious Runoff Depth=3.32"
Flow Length=395' Tc=10.2 min CN=79 Runoff=4.5 cfs 0.376 af

Subcatchment CEC-4.0: CEC-4.0 Runoff Area=2.306 ac 0.00% Impervious Runoff Depth=1.43"
Flow Length=910' Tc=15.4 min CN=57 Runoff=2.5 cfs 0.275 af

Subcatchment CEC-5.0: CEC-5.0 Runoff Area=0.594 ac 0.00% Impervious Runoff Depth=0.14"
Flow Length=184' Tc=6.7 min CN=34 Runoff=0.0 cfs 0.007 af

Subcatchment CEC-7.0: CEC-7.0 Runoff Area=1.050 ac 0.00% Impervious Runoff Depth=1.01"
Flow Length=280' Tc=15.0 min CN=51 Runoff=0.7 cfs 0.089 af

Subcatchment CEC-8.0: CEC-8.0 Runoff Area=7.416 ac 0.00% Impervious Runoff Depth=1.22"
Flow Length=1,153' Tc=24.7 min CN=54 Runoff=5.5 cfs 0.752 af

Subcatchment CEC-9.0: CEC-9.0 Runoff Area=0.468 ac 0.00% Impervious Runoff Depth=2.31"
Flow Length=412' Tc=14.1 min CN=68 Runoff=1.0 cfs 0.090 af

Subcatchment CEC16: CEC-16.0 Runoff Area=0.800 ac 0.00% Impervious Runoff Depth=2.75"
Flow Length=207' Tc=15.5 min CN=73 Runoff=1.9 cfs 0.183 af

Subcatchment ECA10: ECA-10.0 Runoff Area=6.960 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=1,018' Tc=16.6 min CN=71 Runoff=15.0 cfs 1.492 af

Subcatchment ECA11: ECA 11.0 Runoff Area=0.540 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=300' Slope=0.2400 '/' Tc=9.0 min CN=71 Runoff=1.4 cfs 0.116 af

Subcatchment ECA12: ECA 12.0 Runoff Area=1.310 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=233' Tc=9.2 min CN=71 Runoff=3.5 cfs 0.281 af

Subcatchment ECA13: ECA 13.0 Runoff Area=2.700 ac 0.00% Impervious Runoff Depth=2.84"
Flow Length=345' Tc=11.2 min CN=74 Runoff=7.5 cfs 0.640 af

Subcatchment ECA16: ECA 16.0 Runoff Area=2.890 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=710' Tc=12.7 min CN=71 Runoff=6.9 cfs 0.619 af

Subcatchment ECA4: ECA-4.0 Runoff Area=2.990 ac 0.00% Impervious Runoff Depth=2.66"
Flow Length=501' Tc=20.7 min CN=72 Runoff=6.1 cfs 0.663 af

Subcatchment ECA6: ECA-6.0 Runoff Area=3.620 ac 0.00% Impervious Runoff Depth=2.48"
Flow Length=688' Tc=18.1 min CN=70 Runoff=7.3 cfs 0.749 af

Subcatchment ECA7: ECA 7.0 Runoff Area=2.340 ac 0.00% Impervious Runoff Depth=2.66"
Flow Length=395' Tc=14.1 min CN=72 Runoff=5.6 cfs 0.519 af

Subcatchment ECA8: ECA 8.0 Runoff Area=3.620 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=445' Tc=13.3 min CN=71 Runoff=8.5 cfs 0.776 af

Subcatchment ECA9: ECA 9.0 Runoff Area=0.570 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=408' Tc=10.8 min CN=71 Runoff=1.4 cfs 0.122 af

Subcatchment ECATS1: ECA TS-1.0 Runoff Area=0.360 ac 0.00% Impervious Runoff Depth=2.66"
Flow Length=285' Tc=14.1 min CN=72 Runoff=0.9 cfs 0.080 af

Subcatchment ECATS2: ECA TS-2.0 Runoff Area=0.630 ac 0.00% Impervious Runoff Depth=2.75"
Flow Length=433' Tc=15.2 min CN=73 Runoff=1.5 cfs 0.144 af

Subcatchment ECATS3: ECA TS-3.0 Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=2.75"
Flow Length=558' Tc=13.6 min CN=73 Runoff=1.7 cfs 0.156 af

Subcatchment G2CA-1.0: G2CA-1.0 Runoff Area=1.967 ac 0.00% Impervious Runoff Depth=3.12"
Flow Length=573' Tc=19.6 min CN=77 Runoff=4.9 cfs 0.512 af

Subcatchment G2CA-2.0: G2CA-2.0	Runoff Area=2.609 ac 0.00% Impervious Runoff Depth=3.12" Flow Length=461' Tc=18.0 min CN=77 Runoff=6.7 cfs 0.679 af
Subcatchment GCA-1.1: GCA-1.1	Runoff Area=5.209 ac 0.00% Impervious Runoff Depth=3.12" Flow Length=654' Tc=24.5 min CN=77 Runoff=11.8 cfs 1.356 af
Subcatchment GCA-2.0: GCA-2.0	Runoff Area=3.070 ac 0.00% Impervious Runoff Depth=3.12" Flow Length=734' Tc=18.7 min CN=77 Runoff=7.8 cfs 0.799 af
Subcatchment GCA-3.0: GCA-3.0	Runoff Area=3.974 ac 0.00% Impervious Runoff Depth=3.12" Flow Length=858' Tc=17.2 min CN=77 Runoff=10.4 cfs 1.034 af
Subcatchment GCA-4.0: GCA-4.0	Runoff Area=4.894 ac 0.00% Impervious Runoff Depth=3.12" Flow Length=852' Tc=21.2 min CN=77 Runoff=11.8 cfs 1.274 af
Subcatchment GCA-5.0: GCA-5.0	Runoff Area=1.300 ac 0.00% Impervious Runoff Depth=3.12" Flow Length=495' Tc=16.6 min CN=77 Runoff=3.4 cfs 0.338 af
Subcatchment GCA-6.0: GCA-6.0	Runoff Area=3.167 ac 0.00% Impervious Runoff Depth=3.22" Flow Length=431' Tc=19.9 min CN=78 Runoff=8.1 cfs 0.850 af
Subcatchment LLS-1: Level Lip Spreader	Runoff Area=1.160 ac 0.00% Impervious Runoff Depth=3.12" Flow Length=265' Tc=12.3 min CN=77 Runoff=3.4 cfs 0.302 af
Subcatchment PST1: POST-1	Runoff Area=2.500 ac 0.00% Impervious Runoff Depth=2.75" Flow Length=450' Tc=13.5 min CN=73 Runoff=6.3 cfs 0.573 af
Subcatchment PST2: POST-2	Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=2.66" Flow Length=900' Tc=15.7 min CN=72 Runoff=9.2 cfs 0.887 af
Reach 1R: Reach	Avg. Flow Depth=0.80' Max Vel=9.23 fps Inflow=19.1 cfs 1.956 af n=0.040 L=313.0' S=0.1773 '/' Capacity=19.2 cfs Outflow=19.0 cfs 1.956 af
Reach 2R: Reach	Avg. Flow Depth=0.84' Max Vel=7.44 fps Inflow=16.7 cfs 1.675 af n=0.040 L=55.0' S=0.1091 '/' Capacity=19.5 cfs Outflow=16.7 cfs 1.675 af
Reach 3R: Reach	Avg. Flow Depth=0.85' Max Vel=8.47 fps Inflow=19.4 cfs 2.057 af n=0.040 L=313.0' S=0.1406 '/' Capacity=22.2 cfs Outflow=19.2 cfs 2.057 af
Reach 4R: Reach	Avg. Flow Depth=0.20' Max Vel=5.01 fps Inflow=1.4 cfs 0.122 af n=0.040 L=120.0' S=0.2333 '/' Capacity=22.1 cfs Outflow=1.4 cfs 0.122 af
Reach 5R: Reach	Avg. Flow Depth=0.25' Max Vel=4.98 fps Inflow=1.9 cfs 0.183 af n=0.040 L=745.0' S=0.1802 '/' Capacity=19.4 cfs Outflow=1.9 cfs 0.183 af
Reach 6R: Reach	Avg. Flow Depth=0.45' Max Vel=5.86 fps Inflow=5.1 cfs 0.519 af n=0.040 L=325.0' S=0.1323 '/' Capacity=16.6 cfs Outflow=5.0 cfs 0.519 af
Reach 7R: Reach	Avg. Flow Depth=0.59' Max Vel=9.62 fps Inflow=12.2 cfs 1.295 af n=0.040 L=222.0' S=0.2703 '/' Capacity=23.7 cfs Outflow=12.2 cfs 1.295 af

Reach 8R: Reach Avg. Flow Depth=0.73' Max Vel=7.28 fps Inflow=13.0 cfs 1.295 af
n=0.040 L=325.0' S=0.1231 '/' Capacity=16.0 cfs Outflow=12.8 cfs 1.295 af

Reach 9R: ECA TS-3.0 Avg. Flow Depth=0.58' Max Vel=0.41 fps Inflow=1.7 cfs 0.156 af
n=0.150 L=100.0' S=0.0050 '/' Capacity=9.9 cfs Outflow=1.6 cfs 0.156 af

Reach 10R: (new Reach) Avg. Flow Depth=0.40' Max Vel=5.84 fps Inflow=6.6 cfs 0.749 af
n=0.040 L=285.0' S=0.1246 '/' Capacity=89.0 cfs Outflow=6.6 cfs 0.749 af

Reach 13R: ECA TS-1.0 Avg. Flow Depth=0.39' Max Vel=0.33 fps Inflow=0.9 cfs 0.080 af
n=0.150 L=100.0' S=0.0050 '/' Capacity=17.8 cfs Outflow=0.8 cfs 0.080 af

Reach 14R: ECA TS-2.0 Avg. Flow Depth=0.55' Max Vel=0.40 fps Inflow=1.5 cfs 0.144 af
n=0.150 L=100.0' S=0.0050 '/' Capacity=17.8 cfs Outflow=1.4 cfs 0.144 af

Reach R1: Reach Avg. Flow Depth=0.31' Max Vel=6.91 fps Inflow=3.4 cfs 0.338 af
n=0.040 L=190.0' S=0.2789 '/' Capacity=24.1 cfs Outflow=3.4 cfs 0.338 af

Reach R2: Reach Avg. Flow Depth=0.33' Max Vel=4.58 fps Inflow=2.5 cfs 0.275 af
n=0.040 L=178.0' S=0.1124 '/' Capacity=15.3 cfs Outflow=2.5 cfs 0.275 af

Reach R3: Reach Avg. Flow Depth=0.43' Max Vel=9.99 fps Inflow=7.9 cfs 0.850 af
n=0.040 L=358.0' S=0.4134 '/' Capacity=29.4 cfs Outflow=7.8 cfs 0.850 af

Pond 1A: ECA-4.0 Peak Elev=2,111.53' Storage=1,026 cf Inflow=6.1 cfs 0.663 af
15.0" Round Culvert n=0.015 L=68.0' S=0.0368 '/' Outflow=5.5 cfs 0.663 af

Pond 1B: CEC-1.0 Peak Elev=2,103.65' Inflow=5.8 cfs 0.532 af
15.0" Round Culvert n=0.015 L=64.0' S=0.2681 '/' Outflow=5.8 cfs 0.532 af

Pond 1C: GCA-5.0 Peak Elev=2,150.91' Inflow=3.4 cfs 0.338 af
15.0" Round Culvert n=0.015 L=63.0' S=0.0437 '/' Outflow=3.4 cfs 0.338 af

Pond 1P: CCN-2.0 Peak Elev=2,049.78' Storage=9,802 cf Inflow=13.8 cfs 1.528 af
15.0" Round Culvert n=0.015 L=83.0' S=0.0482 '/' Outflow=8.3 cfs 1.528 af

Pond 2A: ECA-6.0 Peak Elev=2,027.62' Storage=978 cf Inflow=7.3 cfs 0.749 af
15.0" Round Culvert n=0.015 L=140.0' S=0.0571 '/' Outflow=6.6 cfs 0.749 af

Pond 2B: CEC-2.0 Peak Elev=2,096.15' Inflow=7.4 cfs 0.715 af
15.0" Round Culvert n=0.015 L=53.0' S=0.0755 '/' Outflow=7.4 cfs 0.715 af

Pond 2C: GCA-2.0 Peak Elev=2,195.90' Inflow=7.8 cfs 0.799 af
15.0" Round Culvert n=0.015 L=60.0' S=0.0917 '/' Outflow=7.8 cfs 0.799 af

Pond 2P: CULV-1-CCS 100+45 Peak Elev=2,199.42' Storage=116 cf Inflow=6.3 cfs 0.573 af
15.0" Round Culvert n=0.015 L=75.0' S=0.0133 '/' Outflow=6.3 cfs 0.573 af

Pond 3A: CEC-16.0 Peak Elev=2,005.78' Storage=36 cf Inflow=1.9 cfs 0.183 af
15.0" Round Culvert n=0.015 L=94.0' S=0.1277 '/' Outflow=1.9 cfs 0.183 af

Pond 3B: CEC-4.0
Peak Elev=1,885.93' Inflow=2.5 cfs 0.275 af
15.0" Round Culvert n=0.015 L=42.0' S=0.0952 '/' Outflow=2.5 cfs 0.275 af

Pond 3C: GCA-3.0
Peak Elev=2,148.64' Inflow=10.4 cfs 1.034 af
18.0" Round Culvert n=0.015 L=74.0' S=0.1351 '/' Outflow=10.4 cfs 1.034 af

Pond 3P: CULV-2-CCS 105+80
Peak Elev=2,160.72' Storage=290 cf Inflow=9.2 cfs 0.887 af
15.0" Round Culvert n=0.015 L=75.0' S=0.0053 '/' Outflow=9.4 cfs 0.887 af

Pond 4A: ECA-10.0
Peak Elev=1,858.21' Storage=264 cf Inflow=16.8 cfs 1.675 af
24.0" Round Culvert n=0.015 L=90.0' S=0.1139 '/' Outflow=16.7 cfs 1.675 af

Pond 4B: CEC-5.0
Peak Elev=1,860.68' Inflow=2.5 cfs 0.282 af
15.0" Round Culvert n=0.015 L=135.0' S=0.0867 '/' Outflow=2.5 cfs 0.282 af

Pond 4C: GCA-4.0
Peak Elev=2,140.31' Inflow=11.8 cfs 1.274 af
18.0" Round Culvert n=0.015 L=110.0' S=0.1045 '/' Outflow=11.8 cfs 1.274 af

Pond 4P: CCS-1.0
Peak Elev=1,631.91' Storage=1,502 cf Inflow=11.6 cfs 1.049 af
15.0" Round Culvert n=0.015 L=150.0' S=0.1333 '/' Outflow=9.7 cfs 1.049 af

Pond 5A: ECA-11.0
Peak Elev=1,788.40' Storage=138 cf Inflow=1.4 cfs 0.116 af
15.0" Round Culvert n=0.015 L=135.0' S=0.1981 '/' Outflow=1.4 cfs 0.116 af

Pond 5B: CEC-7.0
Peak Elev=1,849.45' Inflow=0.7 cfs 0.089 af
15.0" Round Culvert n=0.015 L=58.0' S=0.1724 '/' Outflow=0.7 cfs 0.089 af

Pond 5C: GCA-6.0
Peak Elev=2,129.12' Storage=476 cf Inflow=8.1 cfs 0.850 af
18.0" Round Culvert n=0.015 L=90.0' S=0.0222 '/' Outflow=7.9 cfs 0.850 af

Pond 5P: CEC-12.0
Inflow=6.0 cfs 0.671 af
Primary=6.0 cfs 0.671 af

Pond 6A: ECA-12.0
Peak Elev=1,783.62' Storage=966 cf Inflow=19.0 cfs 1.956 af
24.0" Round Culvert n=0.015 L=106.0' S=0.2193 '/' Outflow=18.4 cfs 1.956 af

Pond 6B: CEC-8.0
Peak Elev=1,803.50' Inflow=5.5 cfs 0.752 af
15.0" Round Culvert n=0.015 L=42.0' S=0.0119 '/' Outflow=5.5 cfs 0.752 af

Pond 6C: G2CA-1.0
Peak Elev=2,102.72' Inflow=4.9 cfs 0.512 af
15.0" Round Culvert n=0.015 L=60.0' S=0.0333 '/' Outflow=4.9 cfs 0.512 af

Pond 6P: CCN-1.0
Peak Elev=2,089.73' Storage=1,530 cf Inflow=11.7 cfs 1.248 af
18.0" Round Culvert n=0.015 L=56.0' S=0.0268 '/' Outflow=10.6 cfs 1.248 af

Pond 7A: ECA-9.0
Peak Elev=1,872.65' Storage=119 cf Inflow=1.4 cfs 0.122 af
15.0" Round Culvert n=0.015 L=119.0' S=0.2269 '/' Outflow=1.4 cfs 0.122 af

Pond 7B: CEC-9.0
Peak Elev=1,811.53' Inflow=1.0 cfs 0.090 af
15.0" Round Culvert n=0.015 L=46.0' S=0.1304 '/' Outflow=1.0 cfs 0.090 af

Pond 7C: G2CA-2.0 Peak Elev=2,098.42' Inflow=6.7 cfs 0.679 af
15.0" Round Culvert n=0.015 L=91.0' S=0.0108 '/' Outflow=6.7 cfs 0.679 af

Pond 8A: ECA-13.0 Peak Elev=1,768.49' Storage=933 cf Inflow=19.2 cfs 2.057 af
24.0" Round Culvert n=0.015 L=102.0' S=0.1667 '/' Outflow=18.9 cfs 2.057 af

Pond 8B: CEC-10.0 Peak Elev=1,831.29' Inflow=4.5 cfs 0.467 af
15.0" Round Culvert n=0.015 L=48.0' S=0.0990 '/' Outflow=4.5 cfs 0.467 af

Pond 8C: CAC-1.0 Peak Elev=1,371.76' Storage=868 cf Inflow=26.3 cfs 3.629 af
24.0" Round Culvert n=0.015 L=52.0' S=0.0038 '/' Outflow=26.1 cfs 3.629 af

Pond 9A: ECA-7.0 Peak Elev=1,970.81' Storage=714 cf Inflow=5.6 cfs 0.519 af
15.0" Round Culvert n=0.015 L=104.0' S=0.0577 '/' Outflow=5.1 cfs 0.519 af

Pond 9C: CAS-0.1 Peak Elev=1,452.96' Inflow=4.0 cfs 0.359 af
15.0" Round Culvert n=0.015 L=86.0' S=0.1070 '/' Outflow=4.0 cfs 0.359 af

Pond 10A: ECA-8.0 Peak Elev=1,879.82' Storage=877 cf Inflow=12.8 cfs 1.295 af
18.0" Round Culvert n=0.015 L=78.0' S=0.0737 '/' Outflow=12.2 cfs 1.295 af

Pond 10C: CCS-1.3 Peak Elev=1,465.17' Inflow=24.2 cfs 2.716 af
18.0" Round Culvert n=0.015 L=56.0' S=0.0089 '/' Outflow=24.2 cfs 2.716 af

Pond 11A: ECA-16.0 Peak Elev=1,667.62' Storage=376 cf Inflow=6.9 cfs 0.619 af
15.0" Round Culvert n=0.015 L=95.0' S=0.1368 '/' Outflow=6.6 cfs 0.619 af

Pond 11C: CEC-2.3 Peak Elev=1,977.74' Inflow=10.6 cfs 1.226 af
18.0" Round Culvert n=0.015 L=53.0' S=0.2736 '/' Outflow=10.6 cfs 1.226 af

Pond 12C: GCA-1.1 Peak Elev=2,210.32' Inflow=11.8 cfs 1.356 af
18.0" Round Culvert n=0.015 L=56.0' S=0.0089 '/' Outflow=11.8 cfs 1.356 af

Pond 13C: CAS-1.0 Peak Elev=1,463.71' Inflow=19.7 cfs 1.894 af
24.0" Round Culvert n=0.015 L=75.0' S=0.0600 '/' Outflow=19.7 cfs 1.894 af

Pond CV-CEC-15.0: (new Pond) Inflow=11.2 cfs 1.303 af
Primary=11.2 cfs 1.303 af

Total Runoff Area = 143.484 ac Runoff Volume = 31.760 af Average Runoff Depth = 2.66"
100.00% Pervious = 143.484 ac 0.00% Impervious = 0.000 ac

Level Lip Spreader Sizing

New Hampshire DES BMP Manual Section 4.6 (Conveyance Practices) refers to Maine DEP for Level Lip Spreader (LLS) design. Maine bases its design on 0.25 cfs per linear foot of LLS for the 10 year frequency storm. Our design was based on the 50 year storm as shown in the Hydrocad Output in the Appendix of this application. The 50 year flow was 4.4 cfs.

L=4.4/.25=18 feet

All level lip spreaders for the Wild Meadows Project are proposed to be 18'.

Note: The minimum length required is 12 feet (per MDEP).

Summary for Subcatchment LLS-1: Level Lip Spreader

Runoff = 4.4 cfs @ 12.17 hrs, Volume= 0.386 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.58"

	Area (ac)	CN	Description
*	0.283	96	Gravel
	0.230	58	Meadow, non-grazed, HSG B
	0.249	78	Meadow, non-grazed, HSG D
	0.337	77	Woods, Good, HSG D
	0.061	55	Woods, Good, HSG B
	1.160	77	Weighted Average
	1.160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.1200	0.14		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
0.6	93	0.2900	2.69		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.2	72	0.0300	6.84	82.10	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.040
12.3	265	Total			

Summary for Subcatchment LLS-1: Level Lip Spreader

Runoff = 4.4 cfs @ 12.17 hrs, Volume= 0.386 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-39.95 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.58"

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*	0.283	96	Gravel
	0.230	58	Meadow, non-grazed, HSG B
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	0.337	77	Woods, Good, HSG D
	0.061	55	Woods, Good, HSG B
	1.160	77	Weighted Average
	1.160		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	100	0.1200	0.14		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 2.65"
0.6	93	0.2900	2.69		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
0.2	72	0.0300	6.84	82.10	**Trap/Vee/Rect Channel Flow, C** Bot.W=2.00' D=2.00' Z= 2.0 '/' Top.W=10.00' n= 0.040
12.3	265	Total			

SECTION 4.0 – PLANS

4.1 Design Plans

WILD MEADOWS WIND PROJECT

DANBURY AND ALEXANDRIA, NEW HAMPSHIRE

NOVEMBER 2013

IBERDROLA PROJECT DATA:

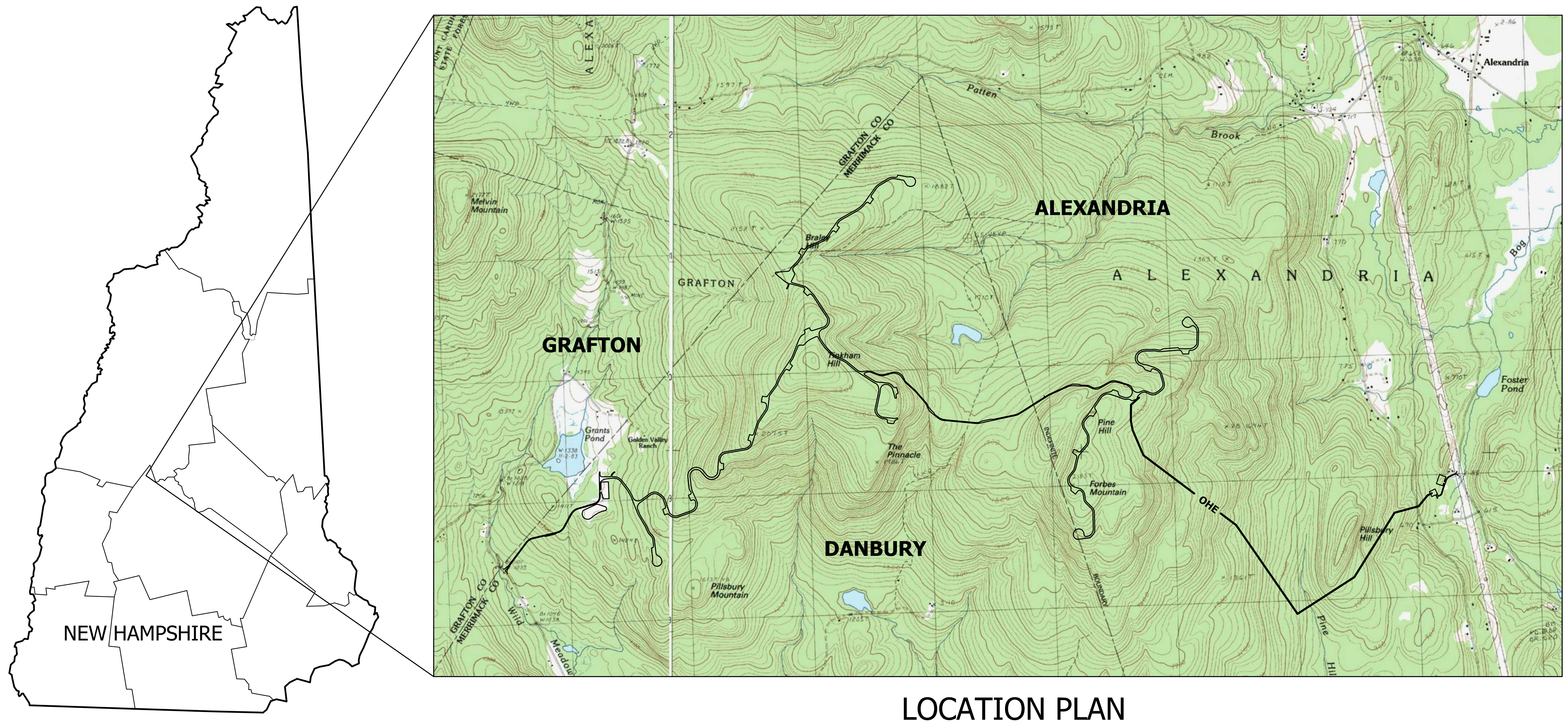
TURBINE TYPE___________ VESTAS V-112
NUMBER OF TURBINES_____ 23
TURBINE & MET LAYOUT___ F-14 (OCTOBER 2013)

ALTA SURVEY____________ WILD MEADOWS PRELIMINARY BOUNDARY SURVEY IN DANBURY, ALEXANDRIA, GRAFTON & ORANGE MERRIMACK & GRAFTON COUNTY, NEW HAMPSHIRE, DATED AUGUST 8, 2010, REVISED JANUARY 7, 2011, PREPARED BY VANASSE HANGEN BRUSTLIN, INC.

LAND CONTROL FILE______ GIS_20121002

TOPOGRAPHIC SURVEY____ PROVIDED BY WSP SELLS & ECKMAN ENGINEERING

WETLAND FILES__________ PROVIDED BY NORMANDEAU ASSOCIATES, INC. 25 NASHUA ROAD, BEDFORD, NH
FILE NAMES: draftsubmittal101513.zip, draftsubmittal110513.zip



LOCATION PLAN
SCALE: 1" = 2000'

SHEET INDEX

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
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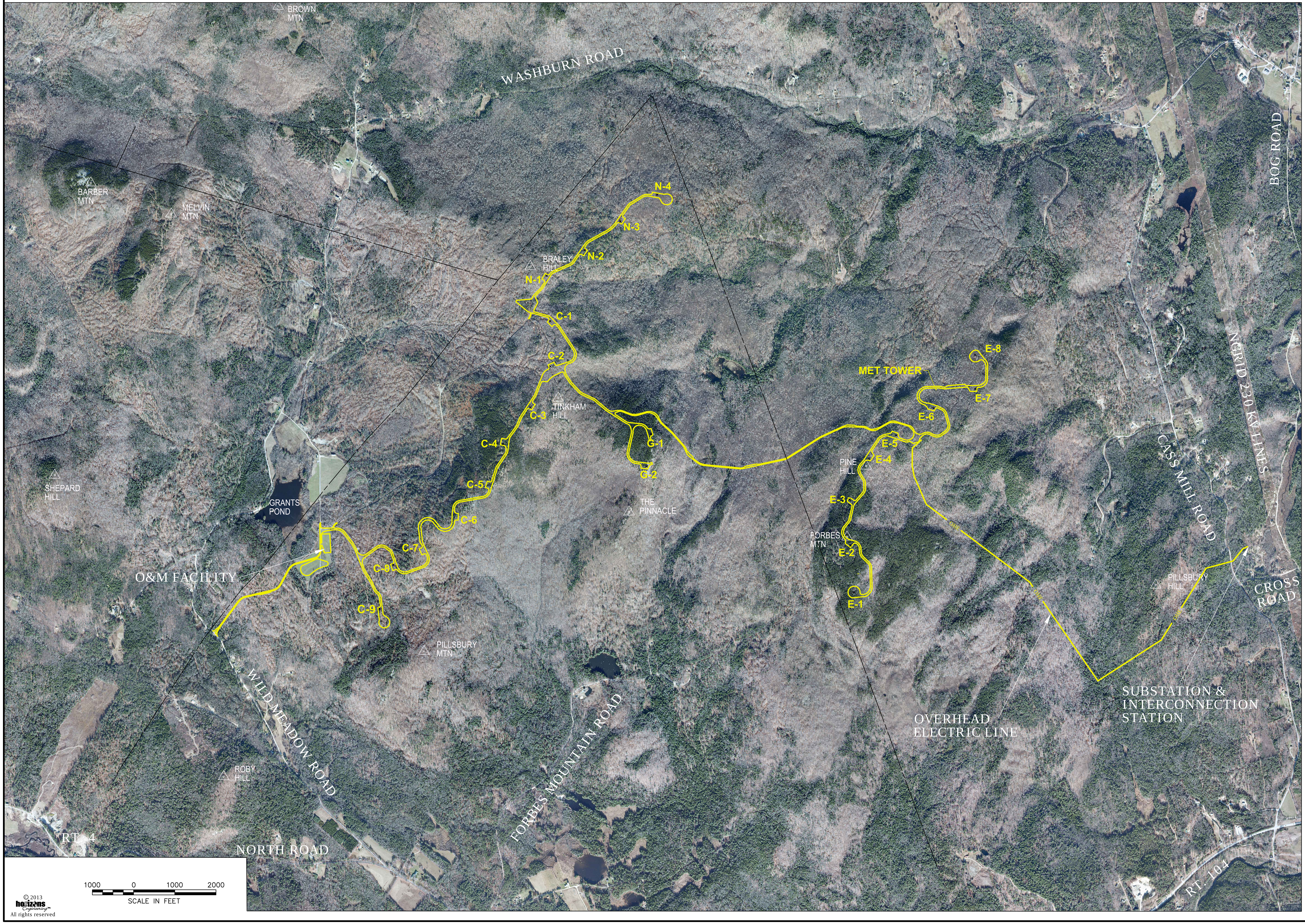
CHECK'D BY:
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE - PROFESSIONAL ENGINEER - ARTHUR JOHN COLVIN No.13828 LICENSED
11/21/13

horizons Engineering Inc
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH
70 PERCENT DESIGN

SHEET TITLE: COVER SHEET SHEET INDEX
SHEET NUMBER: C 1.0



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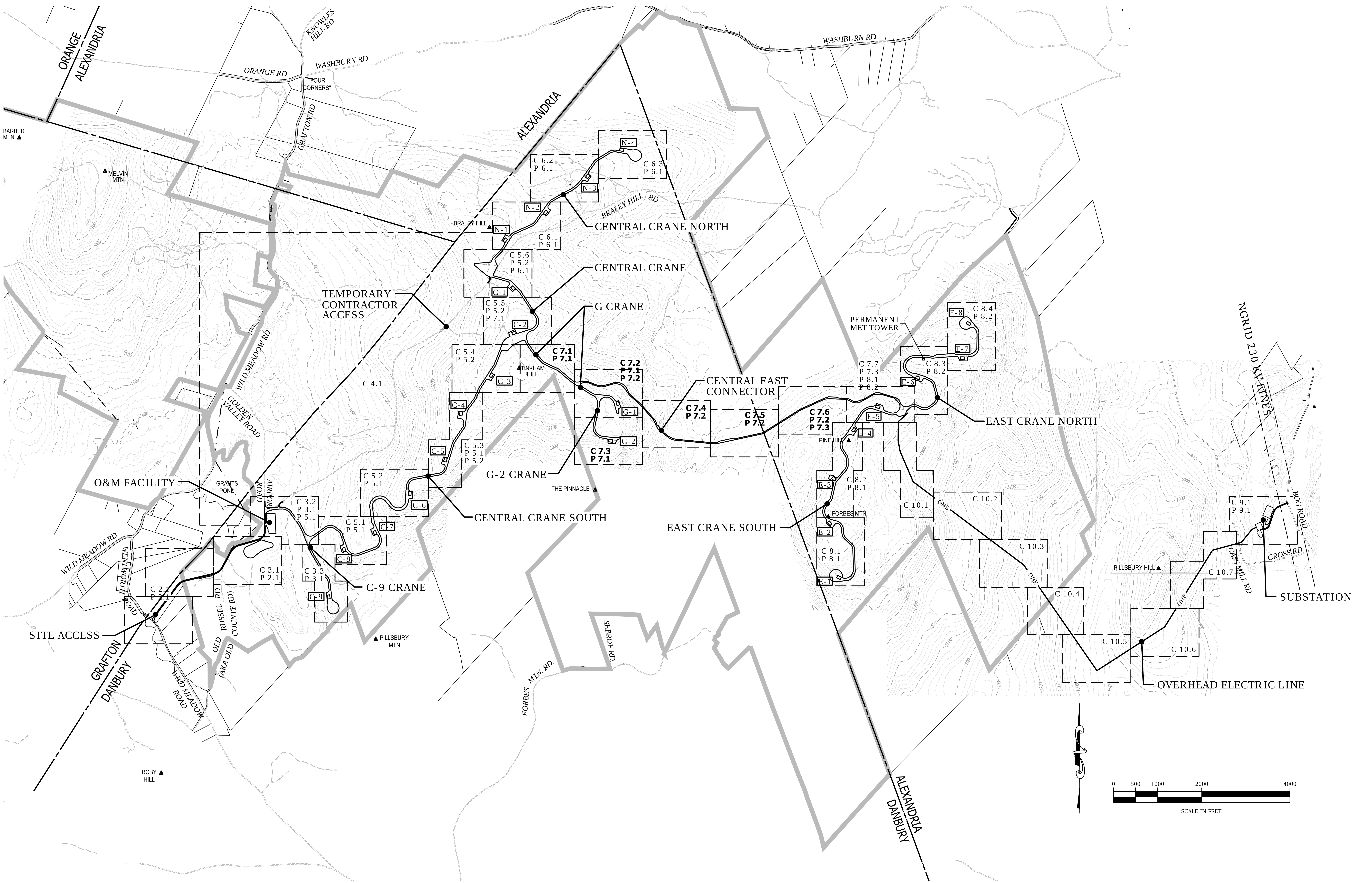
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: AERIAL OVERVIEW

SHEET NUMBER: C 1.1



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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: OVERVIEW PLAN SHEET LAYOUT

SHEET NUMBER: C 1.2

GENERAL NOTES

1. ALL WORK SHALL BE CONSTRUCTED IN ACCORDANCE WITH THESE PLANS AND TECHNICAL SPECIFICATIONS FOR "IBERDROLA RENEWABLES - WILD MEADOWS WIND PROJECT".
2. NO EXISTING MONUMENTS, BOUNDS, OR BENCHMARKS SHALL BE DISTURBED WITHOUT FIRST MAKING PROVISIONS FOR RELOCATION.
3. ALL WORK SHALL BE PERFORMED WITHIN THE PROPERTY OF, AND EASEMENTS SECURED BY, THE OWNER.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DATA COLLECTION AND PREPARATION OF RECORD DRAWINGS.
5. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR CONTROLLING EROSION IN ALL AREAS DISTURBED BY HIS ACTIONS. COSTS FOR REQUIRED EROSION CONTROL, REGARDLESS OF WHETHER OR NOT SUCH MEASURES ARE SHOWN ON THE ENGINEERING DRAWINGS, SHALL BE BORNE BY HIM.
6. UTILITY LOCATIONS ARE BASED ON THE BEST AVAILABLE INFORMATION. THE CONTRACTOR IS RESPONSIBLE FOR LOCATION AND PROTECTION OF EXISTING UTILITIES AND SHALL REPAIR ANY DAMAGE AS QUICKLY AS POSSIBLE AT HIS OWN EXPENSE. ALL UTILITIES ENCOUNTERED SHALL BE LOCATED BY DEPTH AND TIES AND SHOWN BY THE CONTRACTOR ON HIS "AS BUILT" DRAWINGS. HAND EXCAVATION SHALL BE DONE WHEREVER UNDERGROUND UTILITIES ARE SHOWN OR ANTICIPATED. THE CONTRACTOR SHALL CONTACT DIG SAFE AND THE APPROPRIATE AUTHORITIES PRIOR TO ANY CONSTRUCTION IN ORDER TO VERIFY EXISTING CONDITIONS AND UTILITY LOCATIONS.
7. THE OWNER IS RESPONSIBLE FOR ALL FEDERAL AVIATION ADMINISTRATION (FAA) PERMITS AND FILINGS.

   WIND TURBINE GENERATOR (WTG) LOCATIONS ARE BASED ON THE BEST INFORMATION AVAILABLE. DUE TO THE POSSIBILITY OF UNFORSEEN SUBSURFACE CONDITIONS OR CONSTRUCTABILTY CONCERNS WTG LOCATIONS MAY BE MICROSITED. THESE MOVES SHALL BE LIMITED AND NO MORE THAN ALLOWABLE BY THE FAA. THE FINAL WTG LOCATIONS SHALL BE SHOWN BY THE CONTRACTOR ON HIS "AS BUILT" DRAWINGS.
8. BASE MAP INFORMATION INCLUDING BOUNDARY AND TOPOGRAPHY ON THESE PLANS IS FROM PLANS PREPARED BY:

   BOUNDARY AND ALTA SURVEY BY : VANASSE HANGEN BRUSTLIN, INC.

   TOPOGRAPHY BY: WSP SELLS & ECKMAN ENGINEERING
9. CONTRACTOR IS RESPONSIBLE FOR ALL SAFETY MEASURES DURING AND UP TO THE COMPLETION OF CONSTRUCTION OF THE PROJECT.

LEGEND

EXISTING
- 1610 EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- TOWN BOUNDARY LINE
- LEASE BOUNDARY LINE
- PROPERTY LINE
- NON-PARTICIPATING LANDOWNER
- EXISTING TREELINE
- EXISTING STONE WALL
- EXISTING PATH
- EXISTING ROAD

WETLANDS
- TS304p — DELINEATED PERENNIAL STREAM WITH DELINEATED TOP OF BANK
- FS266i — IMPACT FS266i PERM. 214 SF / 72 LF TEMP. 109 SF / 37 LF — DELINEATED INTERMITTENT STREAM WITH ESTIMATED BANK (TEMPORARY AND PERMANENT IMPACTS)
- FS102e — DELINEATED EPHEMERAL STREAM
- FW276 PFO1 — IMPACT FW276 PERM. 568 SF TEMP. 233 SF — DELINEATED WETLAND WITH LABEL AND IMPACTS (TEMPORARY AND PERMANENT)
- TVP03 Value (C) — IMPACT TVP03 PERM. 117 SF TEMP. 0 SF — DELINEATED VERNAL POOL WITH LABEL AND IMPACTS (TEMPORARY AND PERMANENT)

DIRECT PERMANENT IMPACTS ARE HATCHED. DIRECT TEMPORARY IMPACTS ARE OUTLINED SECONDARY AND BUFFER IMPACTS ARE TABULATED BUT NOT SHOWN ON CIVIL DESIGN PLANS

- APPROXIMATE LOCATION OF MICA MINE — LOCATION AND DESCRIPTION OF EXISTING MINE

PROPOSED
- 1610 PROPOSED MAJOR CONTOUR
- 1608 PROPOSED MINOR CONTOUR
- EDGE OF GRAVEL PERMANENT ROAD
- EDGE OF GRAVEL CONSTRUCTION ROAD
- PROPOSED LIMIT OF DISTURBANCE AND CLEARING LIMIT
- OHE PROPOSED OVERHEAD ELECTRIC LINE (34.5 KV)
- UGE PROPOSED UNDERGROUND ELECTRIC LINE
- PROPOSED CULVERT
- PROPOSED CULVERT WITH OUTLET PROTECTION. USE EROSION TYPE STONE FILL UNLESS OTHERWISE SPECIFIED
- PROPOSED CULVERT WITH SEDIMENT TRAP
- PROPOSED SEDIMENT TRAP
- SHEET MATCHLINE
- E-2 TURBINE ID
- C 16.7 SITE PLAN SHEET NUMBER
- P 16.3 PROFILE SHEET NUMBER
- SITE PLAN DRAWING LIMITS
- PROPOSED FENCE
- PROPOSED GUARDRAIL
- LLS PROPOSED LEVEL LIP SPREADER
- LIMITED CLEARING AREA (STUMPS REMAIN, NO GRUBBING) [OUTSIDE LIMIT OF DISTURBANCE CLEARING]
- HB HAYBALES (TEMPORARY)
- OUTLET PROTECTION
- SF SEDIMENT FENCE
- PT PERC TEST LOCATION AND ID
- TP-2 TEST PIT LOCATION AND ID
- WS PROPOSED WATER SERVICE
- FM PROPOSED FORCE MAIN
- UFO PROPOSED UNDERGROUND FIBER OPTIC LINE
- UGU PROPOSED UTILIY SUPPLIED POWER/ FIBER OPTIC

WETLAND NOTES

1. WETLAND DELINEATION AND LOCATION WAS PERFORMED BY NORMANDEAU ASSOCIATES, INC, CERTIFIED WETLAND SCIENTISTS.
2. WETLAND IMPACTS SHOWN ON THIS PLAN SET ARE BASED UPON THE LINEWORK PROVIDED BY NORMANDEAU ASSOCIATES, INC.

SITE AND ROAD DESIGN

1. PLANS SHOW ACCESS ON THE PROJECT SITE AND THE LAYOUT OF THE PROPOSED VESTAS V112 TURBINE LOCATIONS, CRANE PADS, DELIVERY ROADS, STAGING AREAS, OPERATIONS AND MAINTENANCE BUILDING AND ELECTRICAL SUBSTATION BUILDING. CONSTRUCTION PLANS FOR THE FOUNDATIONS, WIND TURBINES AND ELECTRICAL LINES BY OTHERS.
2. TRAFFIC SIGNAGE AND PAVEMENT MARKINGS WITHIN THE PUBLIC RIGHT OF WAYS SHALL CONFORM TO THE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES.
3. PROPOSED SITE GRADING SHOWN ON THESE PLANS ARE FOR GENERAL INFORMATION ONLY ACTUAL SITE GRADING FOR ROADWAY SLOPES AND DITCHES MAY VARY BASED ON EXISTING SOILS CONDITIONS, TO DEPTH TO BEDROCK AND TYPE OF ROADWAY SLOPE PROPOSED.
4. STAGING AREAS AND VEHICLE PULL-OFFS SHALL BE LOAMED AND SEEDED UPON COMPLETION OF CONSTRUCTION - UNLESS NOTED OTHERWISE.
5. HORIZONTAL ROAD GEOMETRY:

   ACCESS ROADS WIDTH = 22 FEET TEMPORARY 16 FEET PERMANENT

   CRANE ROADS WIDTH = 40 FEET TEMPORARY 16 FEET PERMANENT

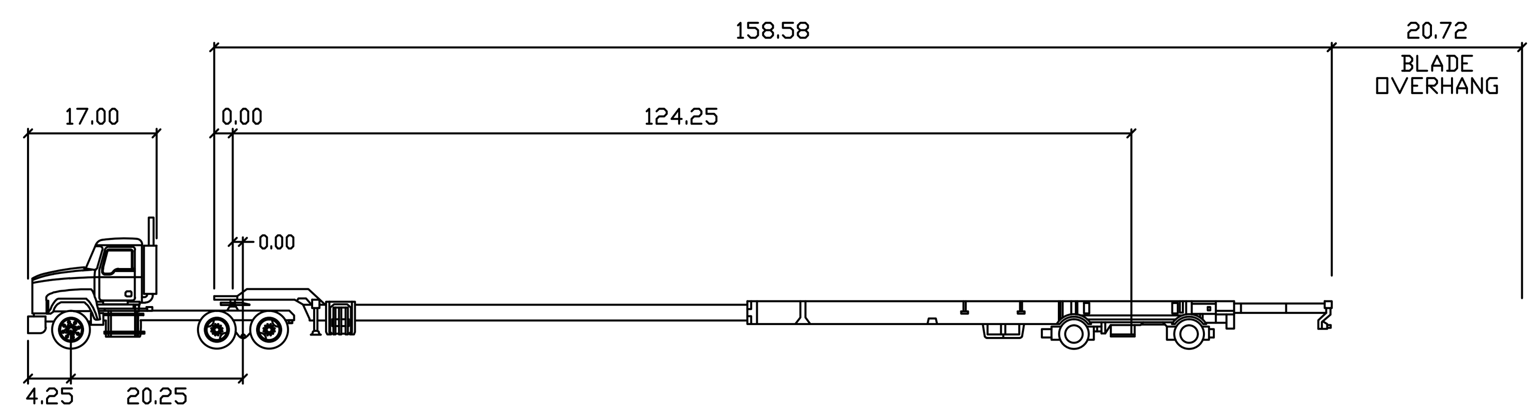
   MINIMUM CENTERLINE RADIUS = 185 FEET

   DEAD END TURN AROUND = 165 FEET OUTSIDE RADIUS
6. VERTICAL ROAD GEOMETRY:

   MAXIMUM ACCESS AND CRANE ROAD GRADE = 15%

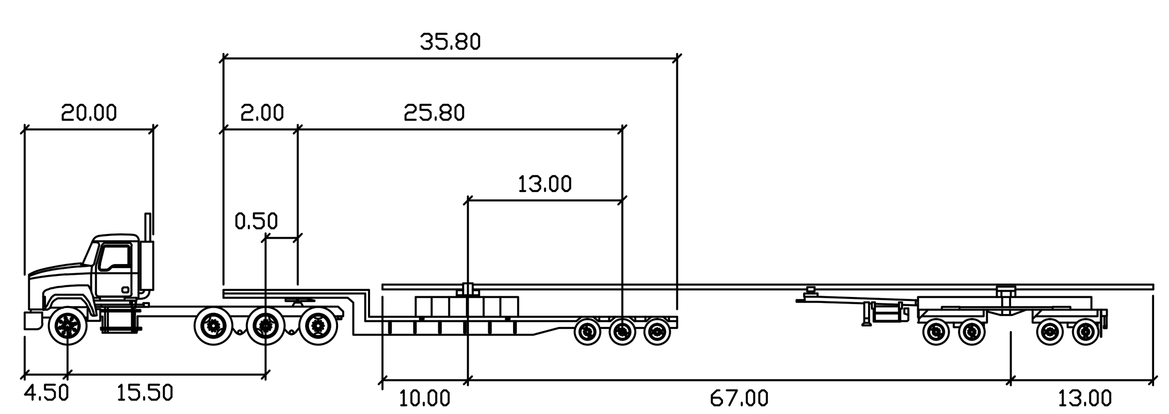
   MINIMUM ACCESS AND CRANE ROAD = 1%

   MINIMUM VERTICAL CURVE K = 16.5
7. CRANE PAD SHALL BE 60 FEET BY 90 FEET AND HAVE A MAXIMUM GRADE OF 1% IN ANY DIRECTION.
8. ACCESS & CRANE ROADS HAVE BEEN DESIGNED TO ACCOMODATE TURBINE COMPONENTS AND TRANSPORT VEHICLES.



TYPICAL V112 BLADE TRAILER TRANSPORT VEHICLE

TRACTOR WIDTH: 8 FT — LOCK TO LOCK TIME : 6.0
TRAILER WIDTH: 8'-6" — STEERING ANGLE: 36.3
TRACTOR TRACK: 8 FT — ARTICULATING ANGLE: 70.0
TRAILER TRACK: 8 FT



TYPICAL V112 TOWER BASE TRANSPORT VEHICLE

TRACTOR WIDTH: 10 FT — LOCK TO LOCK TIME : 6.0
TRAILER WIDTH: 10 FT — STEERING ANGLE: 40.0
TRACTOR TRACK: 10 FT — ARTICULATING ANGLE: 70.0
TRAILER TRACK: 10 FT

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DATE: NOVEMBER 2013
PROJECT #: 13185
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ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE — ARTHUR JOHN COLVIN No. 13528 — PROFESSIONAL ENGINEER — 11/27/13

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34 School Street
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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: GENERAL NOTES, LEGEND, SITE AND ROAD DESIGN CRITERIA

SHEET NUMBER: C 1.3

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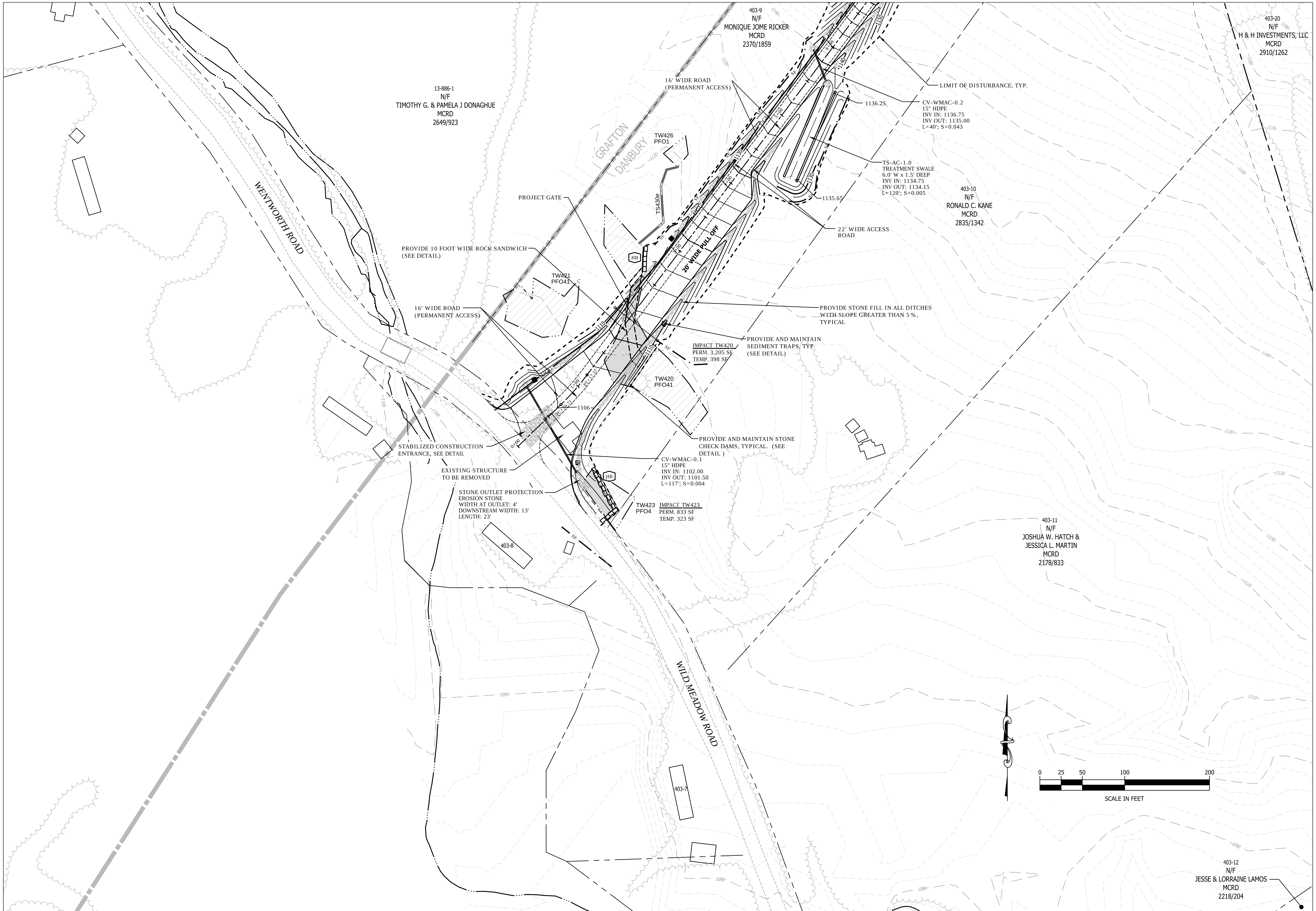

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
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CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No. 13528
PROFESSIONAL ENGINEER
12/3/13

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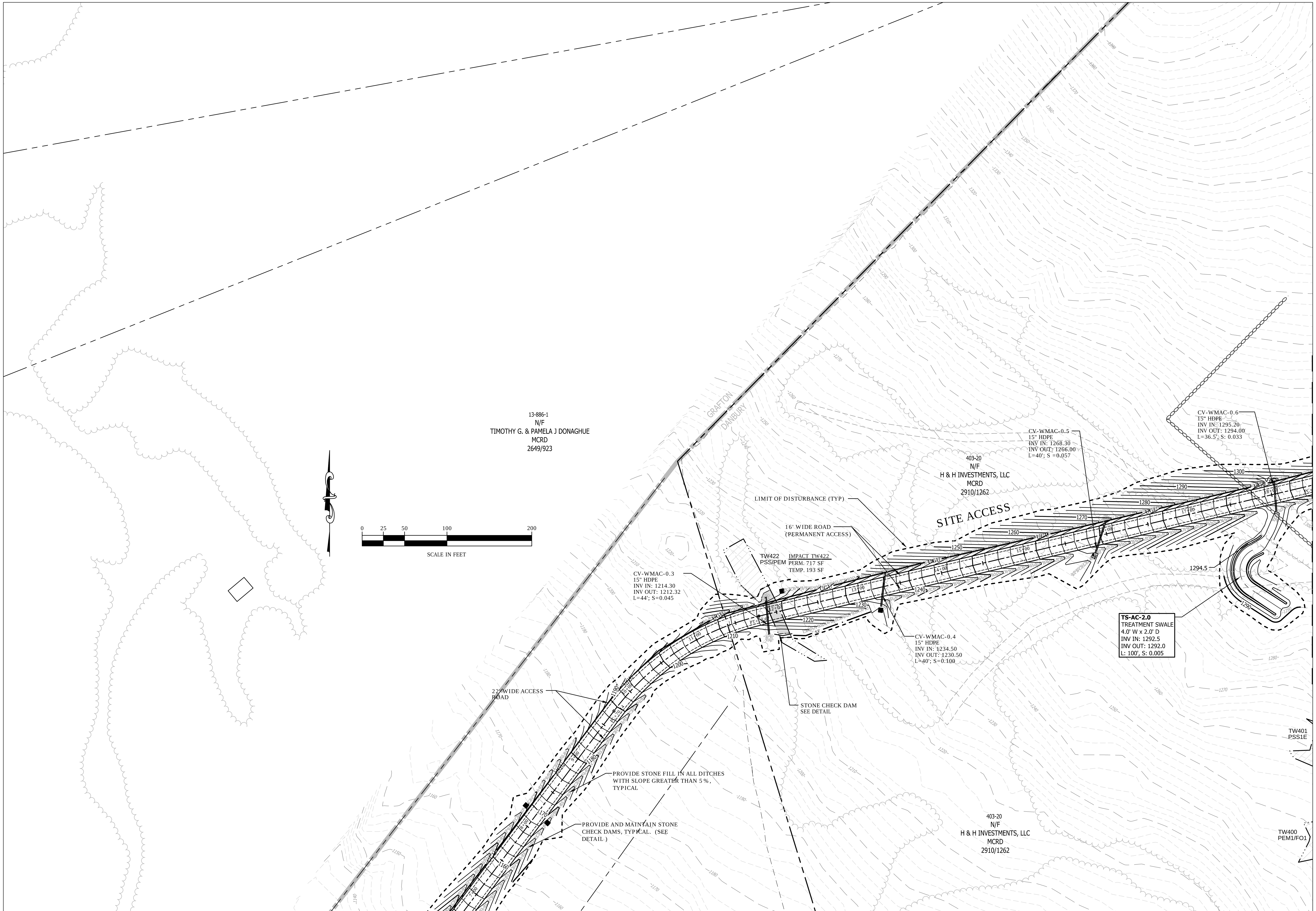
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: SITE ACCESS

SHEET NUMBER: C 2.1



MATCH LINE - SHEET C 2.1

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 PROFESSIONAL ENGINEER 11/27/13

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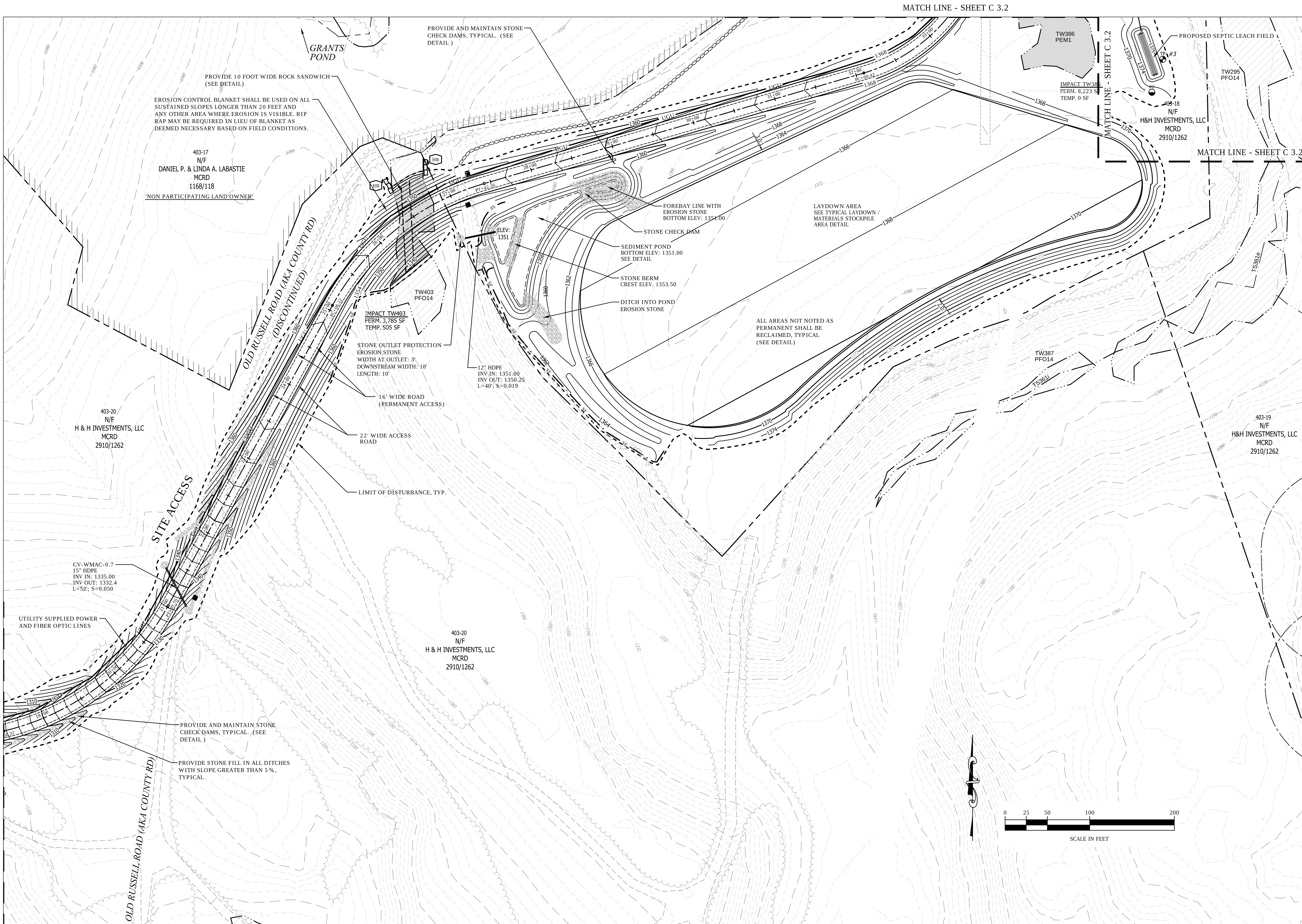
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: SITE ACCESS

SHEET NUMBER: C 2.2



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(SEE PROFILE SHEET: P 3.1)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13528 PROFESSIONAL ENGINEER 11/27/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: SITE ACCESS LAYDOWN AREA

SHEET NUMBER: C 3.1

LEGEND

- SOIL BOUNDARY
- 647B — SOIL CLASSIFICATION
- LIMIT OF SITE SPECIFIC SOIL DELINEATION
- OM-A — PHOTO LOCATION & ID
- TP #1 — TEST PIT LOCATION & ID
- INF — INFILTRATION TEST LOCATION
- PT — PERC TEST LOCATION
- STREAM
- WETLAND BOUNDARY
- TW270 PEM1/FO14 — WETLAND CLASSIFICATION
- VERNAL POOL

SITE-SPECIFIC SOILS INFORMATION

(USED WITHIN THE AREA OF PROPOSED DEVELOPMENT, AS DELINEATED BY RAYMOND LOBDELL, CSS.)

MAPPING UNIT	SOIL TYPE(S)	DRAINAGE CLASS	HSG
56B	BECKET	WELL DRAINED	C
56C	BECKET	WELL DRAINED	C
57C	BECKET, VERRY STONY	WELL DRAINED	C
57D	BECKET, VERRY STONY	WELL DRAINED	C
57E	BECKET, VERRY STONY	WELL DRAINED	C
299Ccaabc	UDORTHENTS	WELL DRAINED	C
299Cccccc	UDORTHENTS	WELL DRAINED	C
299Dccccc	UDORTHENTS	WELL DRAINED	C
299Ceaacc	UDORTHENTS	WELL DRAINED	C
549B	PEACHMAN	VERY POORLY DRAINED	D
558B	SKERRY	MODERATELY WELL DRAINED	C
559B	SKERRY, VERY STONY	MODERATELY WELL DRAINED	C
646B	PILLSBURY	POORLY DRAINED	C
647B	PILLSBURY, VERY STONY	POORLY DRAINED	C
647C	PILLSBURY, VERY STONY	POORLY DRAINED	C

670D — INDICATES SOIL NAME (670) — INDICATES SLOPE OF LAND (D)

A = 0 TO 3 PERCENT SLOPE
B = 3 TO 8 PERRECENT SLOPE
C = 8 TO 15 PERCENT SLOPE
D = 15 TO 25 PERCENT SLOPE

SITE-SPECIFIC SOILS NOTES

1. THIS DETAILED SITE SPECIFIC SOIL MAP CONFIRMS TO THE STANDARDS OF SSSNNE PUBLICATIONS NO.3, AS AMENDED, "SITE-SPECIFIC SOIL MAPPING STANDARDS FOR NH AND VT"
2. MAPPING COMPLETED IN DECEMBER 2012 BY RAYMOND LOBDELL, CSS.
3. SEE ACCOMPANYING NARRATIVE REPORT FOR METHODOLOGY, MAP SYMBOL LEGEND, AND INTERPRETATIONS. THIS MAP WAS COMPLETED TO CONFORM TO THE REQUIREMENTS OF THE NHDES, AOT RULES.

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STATE OF NEW HAMPSHIRE — SARAH ALLEN — No. 083 — CERTIFIED WETLAND SCIENTIST

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG DWG

DATE:	NOVEMBER 7, 2013
PROJECT #:	13185
ENGIN'D BY:	RL
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE — RAYMOND D. LOBDELL — No. 007 — CERTIFIED SOIL SCIENTIST

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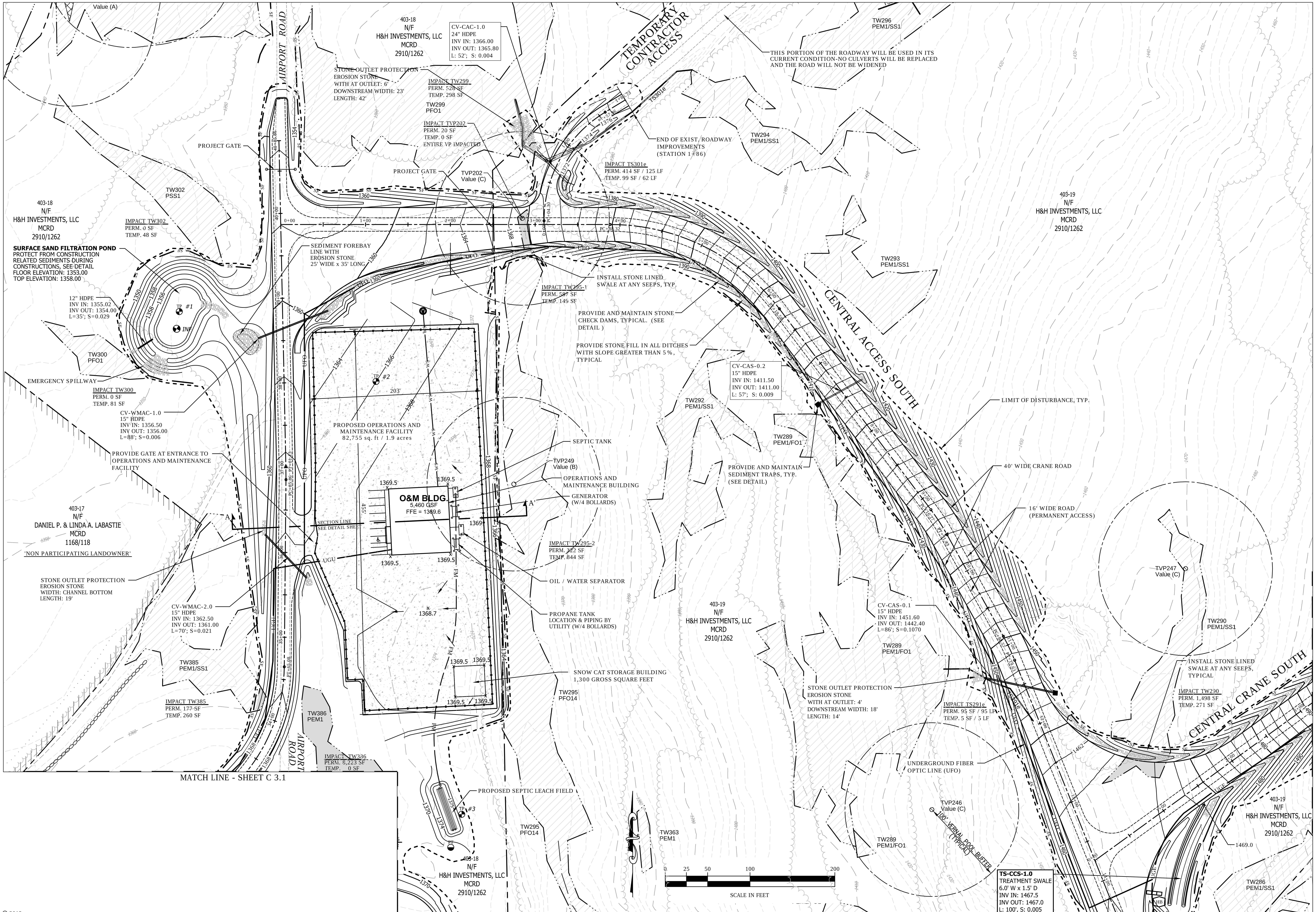
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

SHEET TITLE:
EXISTING CONDITIONS PLAN
OPERATIONS AND MAINTENANCE FACILITY

SHEET NUMBER: C 3.2 Ex



MATCH LINE - SHEET C 3.1

MATCH LINE - SHEET C 3.3

(SEE PROFILE SHEET: P 3.1)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENG'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 PROFESSIONAL ENGINEER LICENSED 12/3/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL ACCESS SOUTH / TEMPORARY CONTRACTOR ACCESS / CENTRAL CRANE SOUTH

SHEET NUMBER: C 3.2

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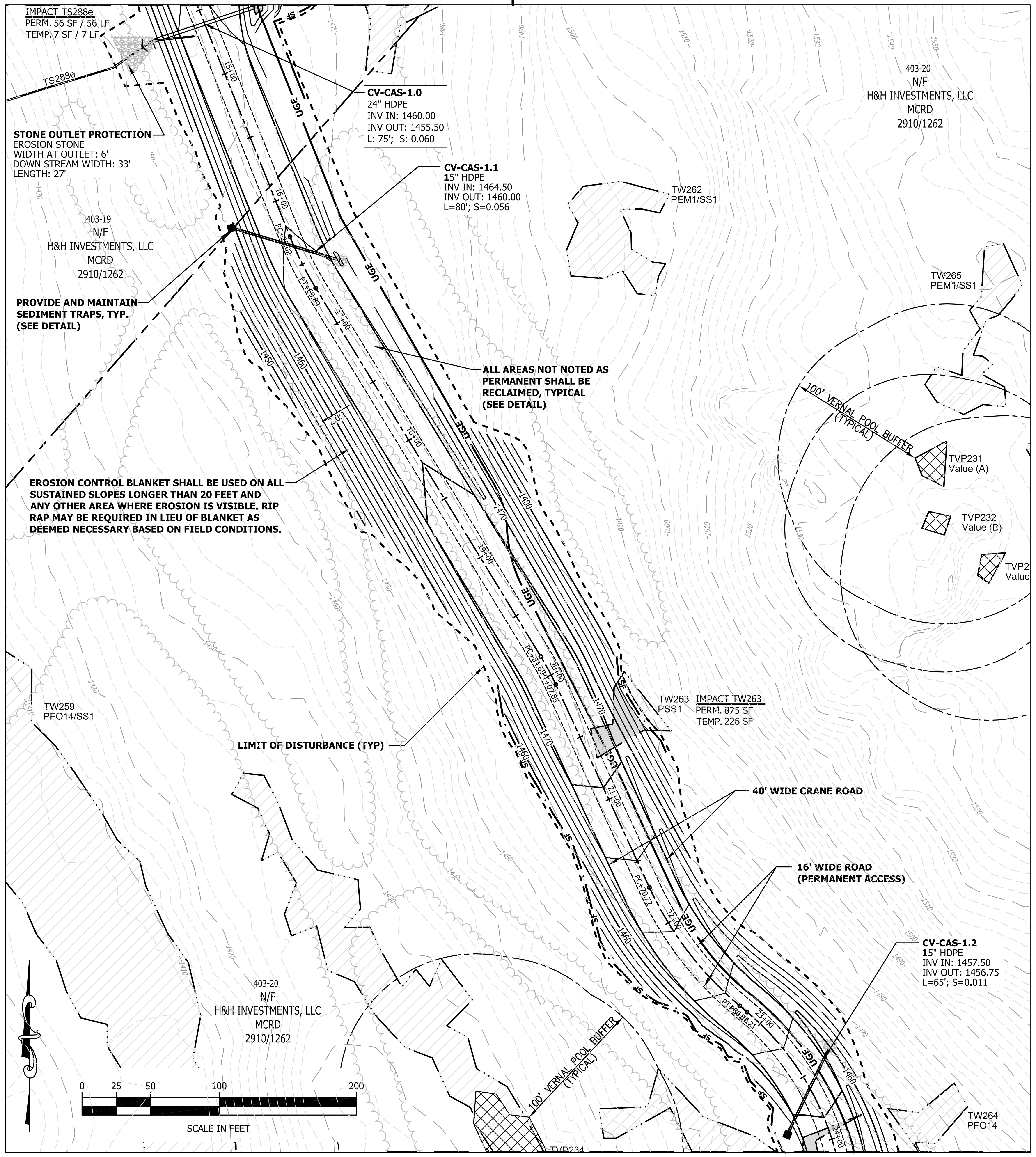

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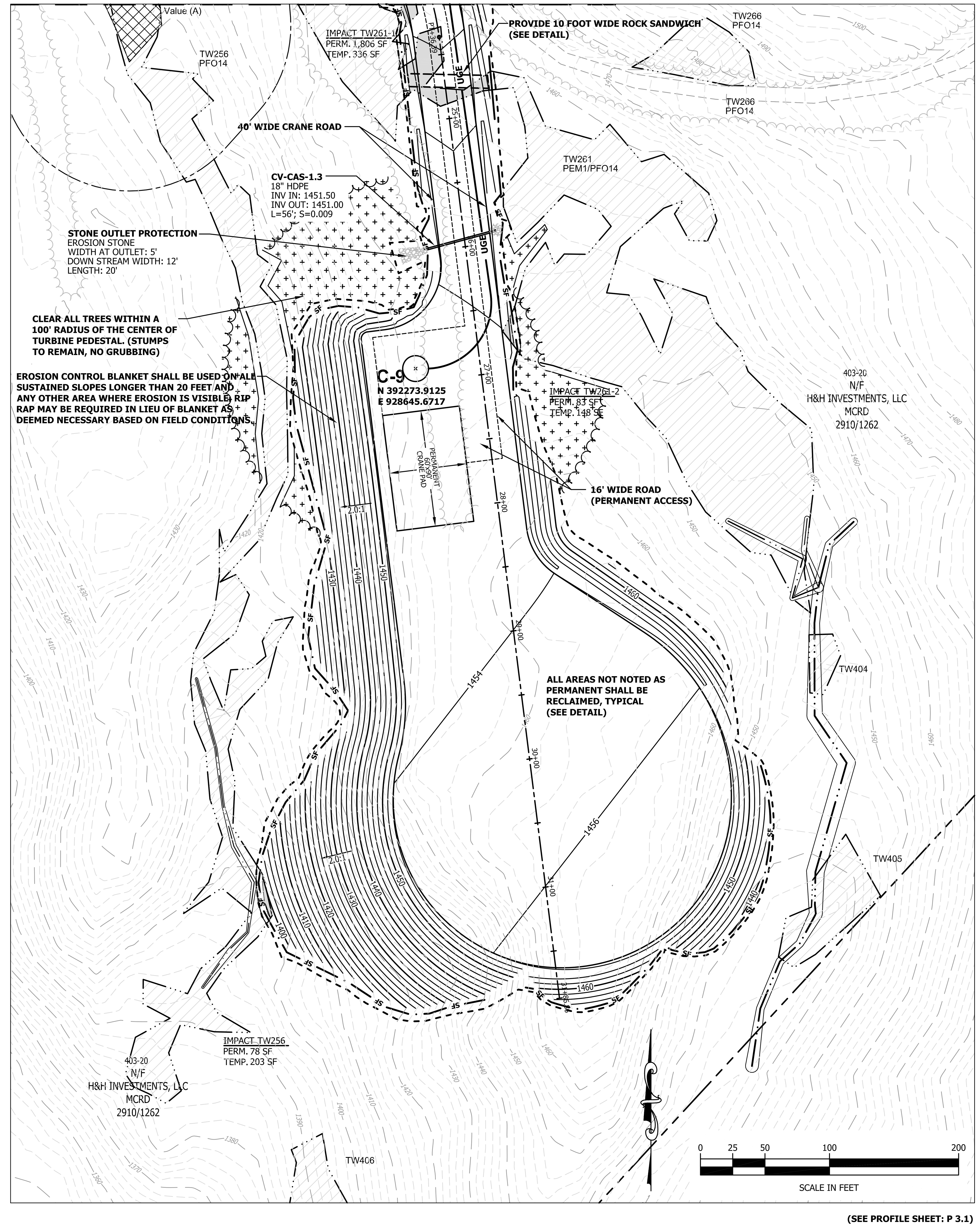

(SEE PROFILE SHEET: P 3.1)

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
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DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 LICENSED PROFESSIONAL ENGINEER 11/21/13

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WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL ACCESS SOUTH TURBINE SITE C-9

SHEET NUMBER: C 3.3

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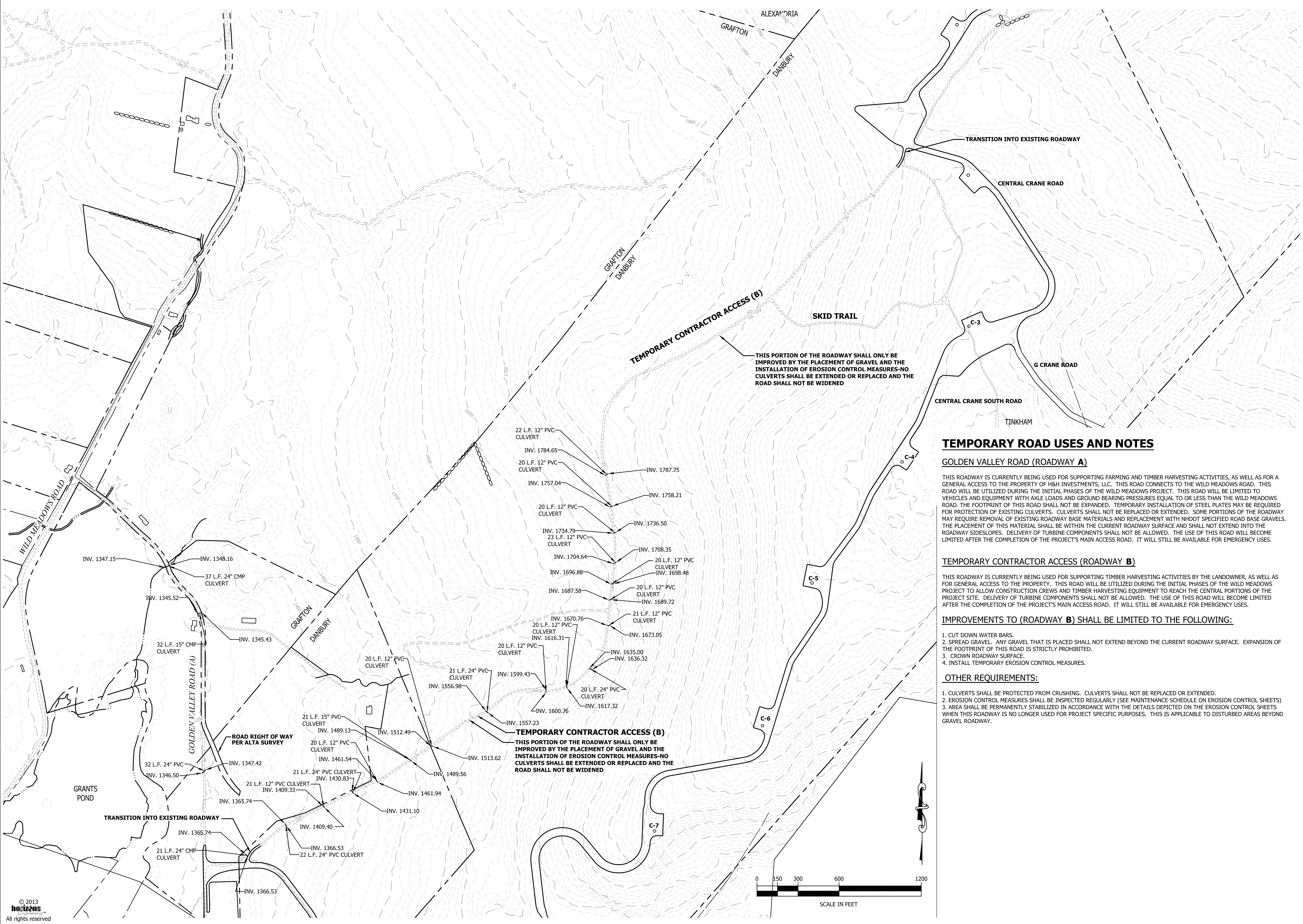

TEMPORARY ROAD USES AND NOTES

GOLDEN VALLEY ROAD (ROADWAY **A**)

THIS ROADWAY IS CURRENTLY BEING USED FOR SUPPORTING FARMING AND TIMBER HARVESTING ACTIVITIES, AS WELL AS FOR A GENERAL ACCESS TO THE PROPERTY OF H&H INVESTMENTS, LLC. THIS ROAD CONNECTS TO THE WILD MEADOWS ROAD. THIS ROAD WILL BE UTILIZED DURING THE INITIAL PHASES OF THE WILD MEADOWS PROJECT. THIS ROAD WILL BE LIMITED TO VEHICLES AND EQUIPMENT WITH AXLE LOADS AND GROUND BEARING PRESSURES EQUAL TO OR LESS THAN THE WILD MEADOWS ROAD. THE FOOTPRINT OF THIS ROAD SHALL NOT BE EXPANDED. TEMPORARY INSTALLATION OF STEEL PLATES MAY BE REQUIRED FOR PROTECTION OF EXISTING CULVERTS. CULVERTS SHALL NOT BE REPLACED OR EXTENDED. SOME PORTIONS OF THE ROADWAY MAY REQUIRE REMOVAL OF EXISTING ROADWAY BASE MATERIALS AND REPLACEMENT WITH NHDOT SPECIFIED ROAD BASE GRAVELS. THE PLACEMENT OF THIS MATERIAL SHALL BE WITHIN THE CURRENT ROADWAY SURFACE AND SHALL NOT EXTEND INTO THE ROADWAY SIDESLOPES. DELIVERY OF TURBINE COMPONENTS SHALL NOT BE ALLOWED. THE USE OF THIS ROAD WILL BECOME LIMITED AFTER THE COMPLETION OF THE PROJECT'S MAIN ACCESS ROAD. IT WILL STILL BE AVAILABLE FOR EMERGENCY USES.

TEMPORARY CONTRACTOR ACCESS (ROADWAY **B**)

THIS ROADWAY IS CURRENTLY BEING USED FOR SUPPORTING TIMBER HARVESTING ACTIVITIES BY THE LANDOWNER, AS WELL AS FOR GENERAL ACCESS TO THE PROPERTY. THIS ROAD WILL BE UTILIZED DURING THE INITIAL PHASES OF THE WILD MEADOWS PROJECT TO ALLOW CONSTRUCTION CREWS AND TIMBER HARVESTING EQUIPMENT TO REACH THE CENTRAL PORTIONS OF THE PROJECT SITE. DELIVERY OF TURBINE COMPONENTS SHALL NOT BE ALLOWED. THE USE OF THIS ROAD WILL BECOME LIMITED AFTER THE COMPLETION OF THE PROJECT'S MAIN ACCESS ROAD. IT WILL STILL BE AVAILABLE FOR EMERGENCY USES.

IMPROVEMENTS TO (ROADWAY **B**) SHALL BE LIMITED TO THE FOLLOWING:

1. CUT DOWN WATER BARS.
2. SPREAD GRAVEL. ANY GRAVEL THAT IS PLACED SHALL NOT EXTEND BEYOND THE CURRENT ROADWAY SURFACE. EXPANSION OF THE FOOTPRINT OF THIS ROAD IS STRICTLY PROHIBITED.
3. CROWN ROADWAY SURFACE.
4. INSTALL TEMPORARY EROSION CONTROL MEASURES.

OTHER REQUIREMENTS:

1. CULVERTS SHALL BE PROTECTED FROM CRUSHING. CULVERTS SHALL NOT BE REPLACED OR EXTENDED.
2. EROSION CONTROL MEASURES SHALL BE INSPECTED REGULARLY (SEE MAINTENANCE SCHEDULE ON EROSION CONTROL SHEETS)
3. AREA SHALL BE PERMANENTLY STABILIZED IN ACCORDANCE WITH THE DETAILS DEPICTED ON THE EROSION CONTROL SHEETS WHEN THIS ROADWAY IS NO LONGER USED FOR PROJECT SPECIFIC PURPOSES. THIS IS APPLICABLE TO DISTURBED AREAS BEYOND GRAVEL ROADWAY.

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NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	AJC
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ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 PROFESSIONAL ENGINEER 11/21/13

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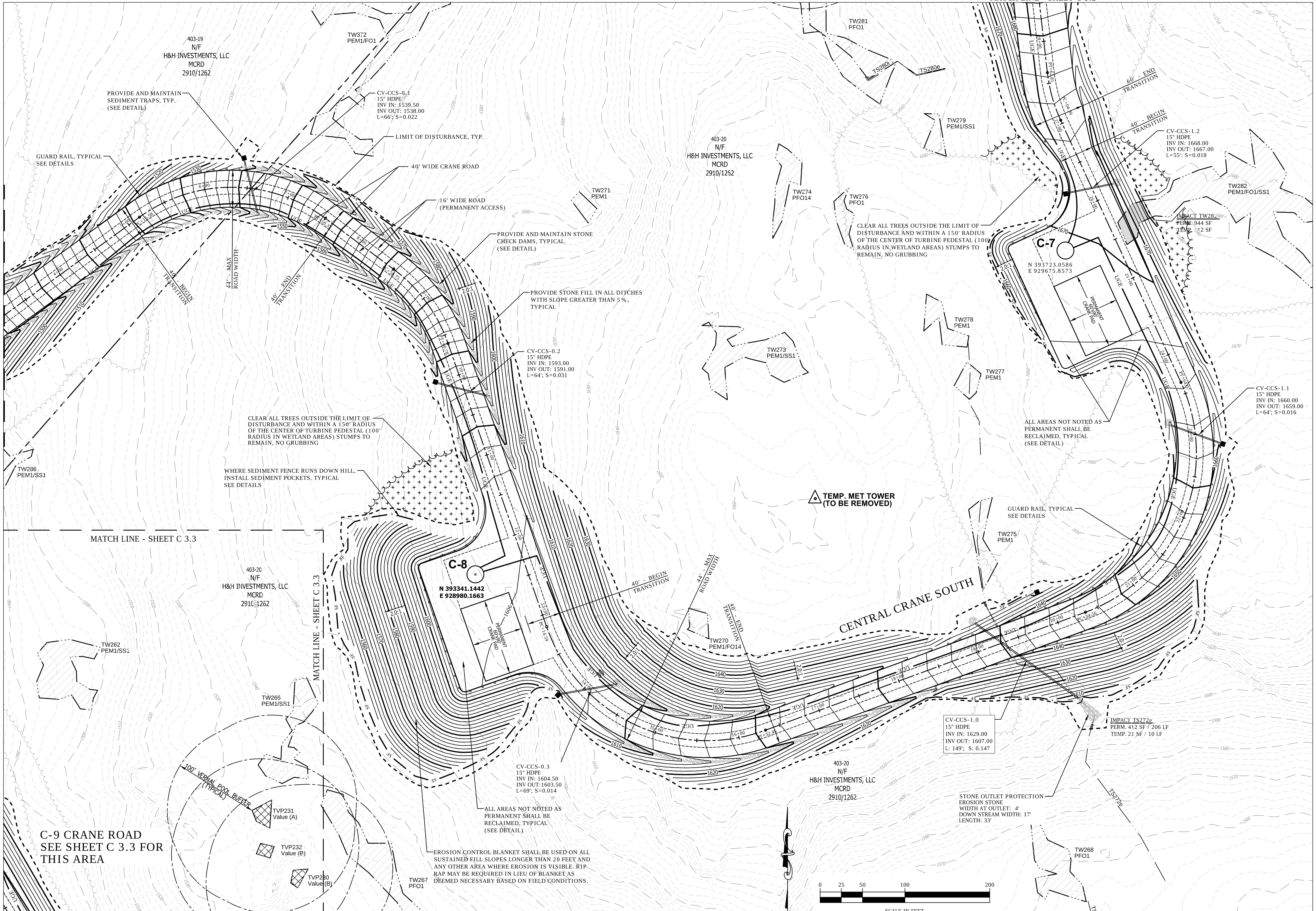
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: NOTES FOR TEMPORARY CONTRACTOR ACCESS

SHEET NUMBER: C 4.1



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NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
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DRAWN BY:	JCD
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ARCHIVE #:	H-5107

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL CRANE SOUTH TURBINE SITES C-7 & C-8

SHEET NUMBER: C 5.1

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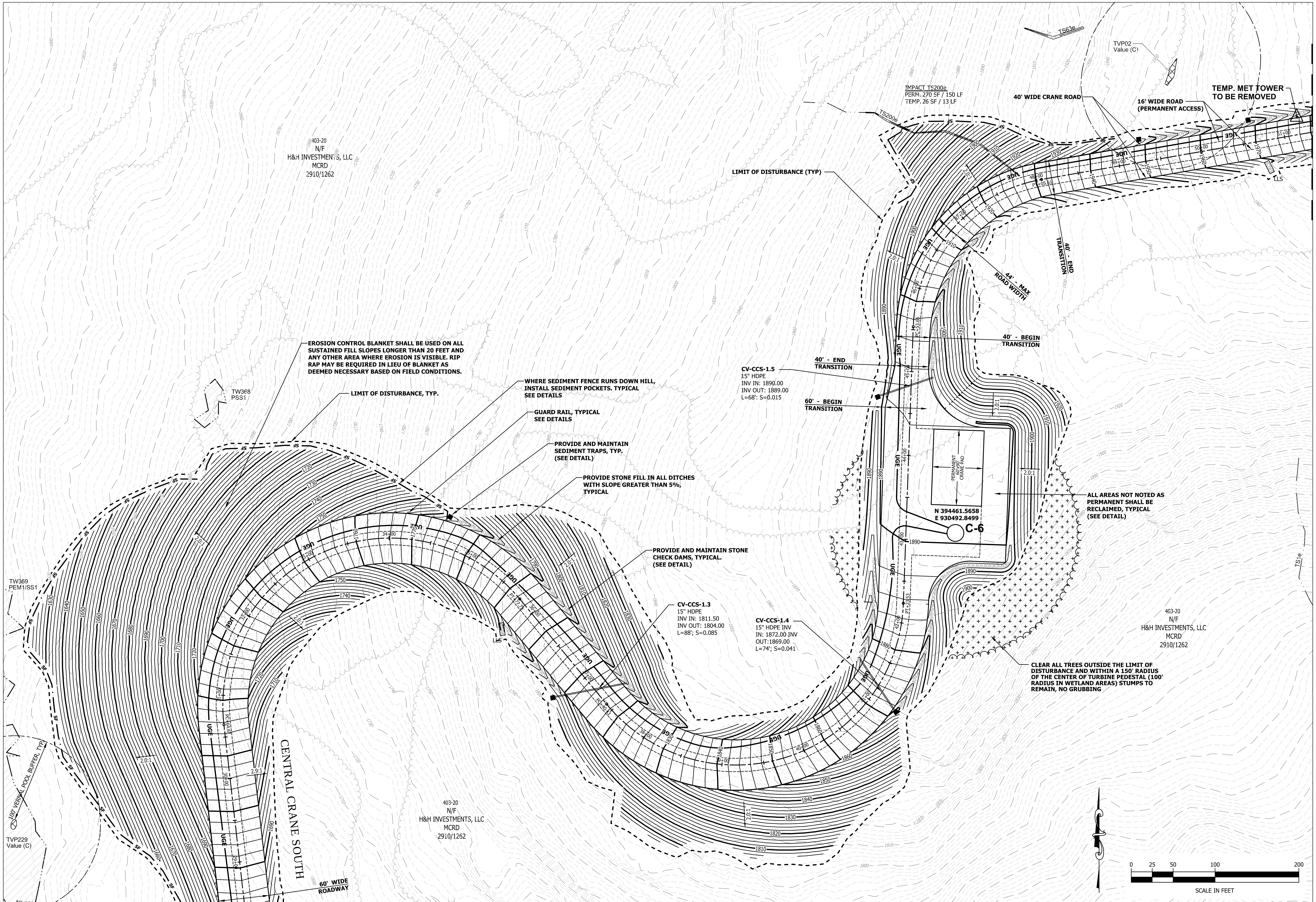

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MATCH LINE - SHEET C 5.1

(SEE PROFILE SHEET: P 5.1)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENG'D BY: JCD
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ARCHIVE #: H-5107

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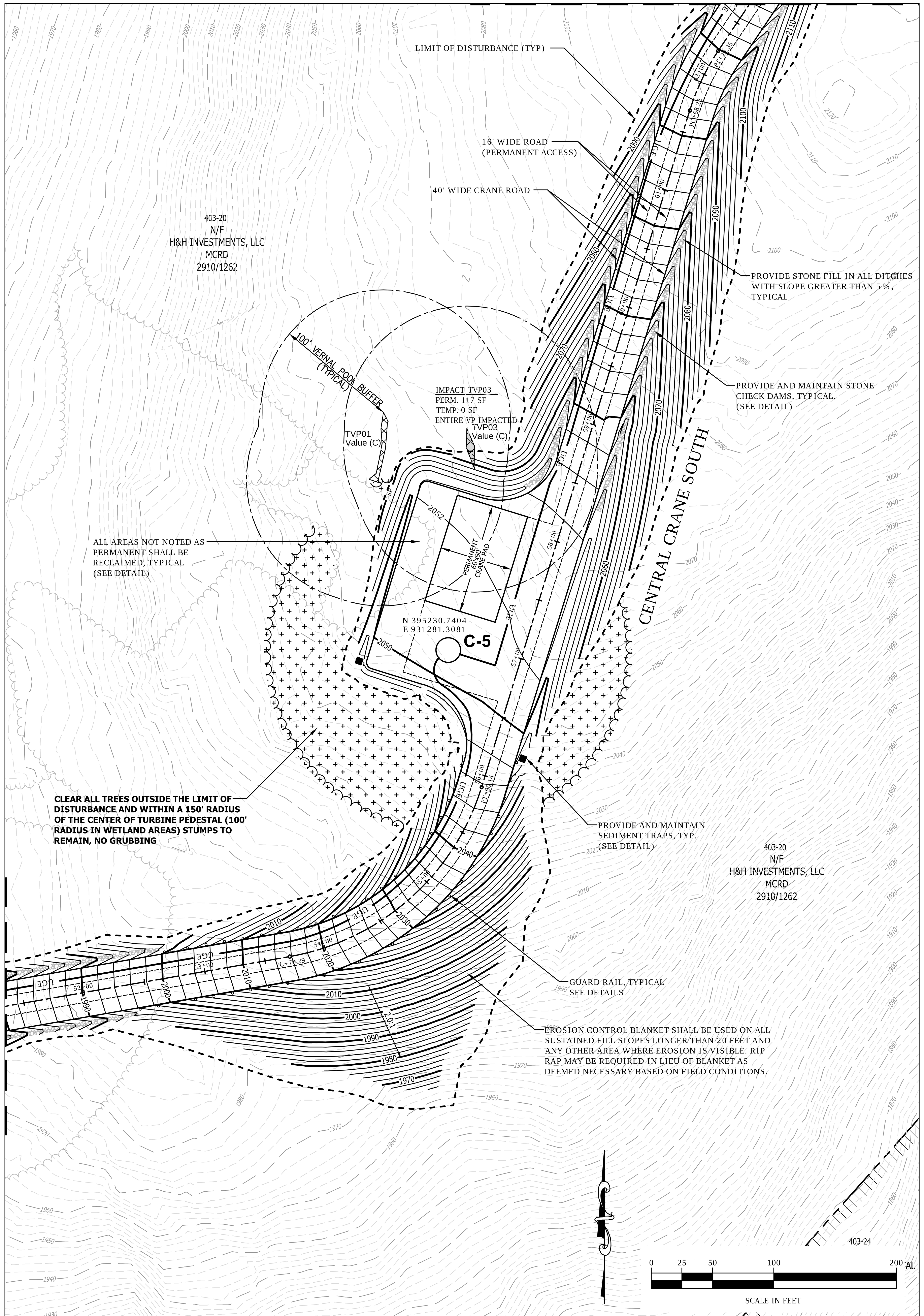
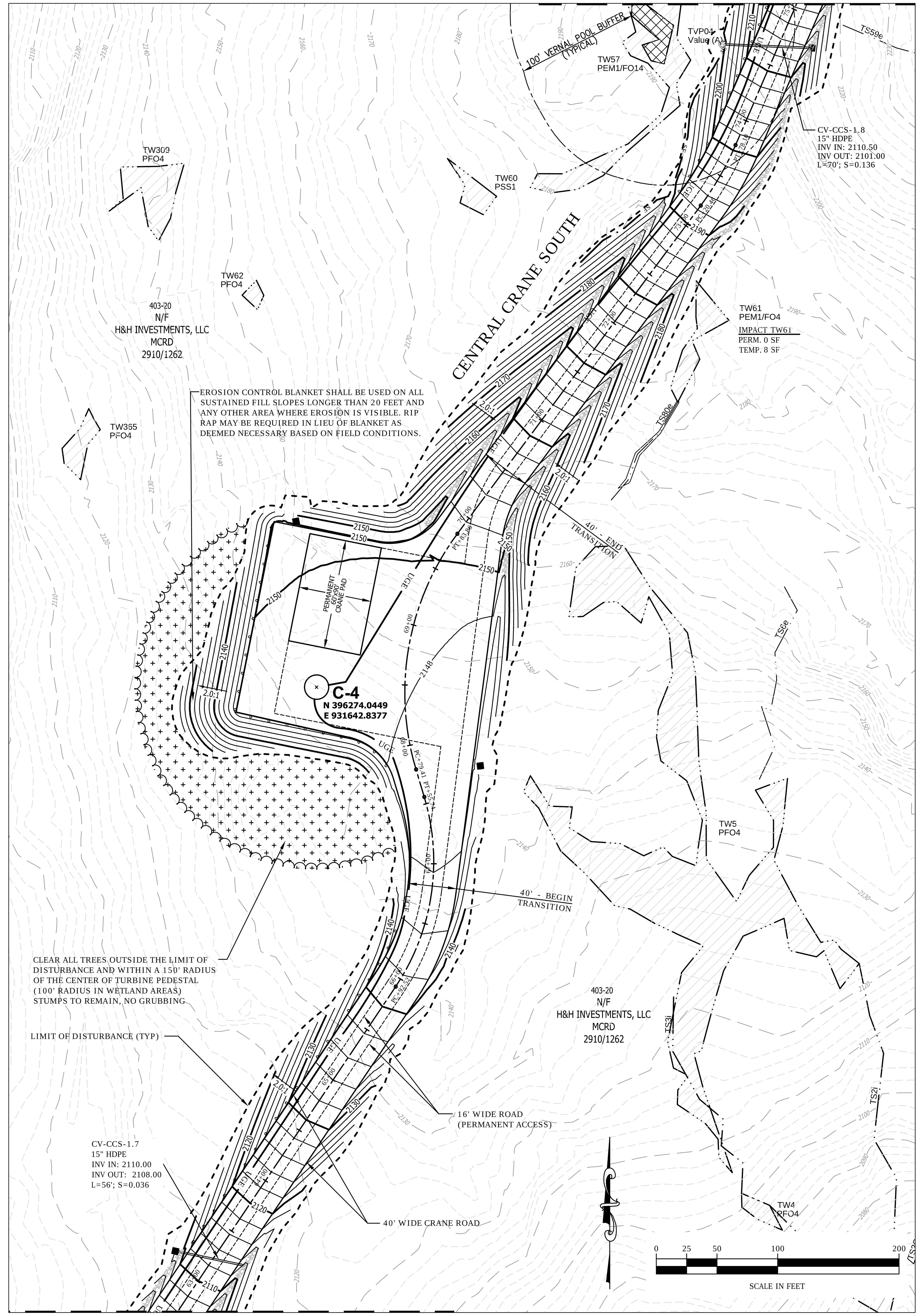
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL CRANE SOUTH TURBINE SITE C-6

SHEET NUMBER: C 5.2





(SEE PROFILE SHEETS: P 5.1 & P 5.2)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	JCD
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CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE — ARTHUR JOHN COLVIN No. 13528 — LICENSED PROFESSIONAL ENGINEER — 11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
CENTRAL CRANE SOUTH
TURBINE SITES C-4 & C-5

SHEET NUMBER: C 5.3

MATCH LINE - SHEET C 5.5

MATCH LINE - SHEET C 7.1

MATCH LINE - SHEET C 5.3

(SEE PROFILE SHEET: P 5.2)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: JCD
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STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13528 PROFESSIONAL ENGINEER 12/3/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL CRANE SOUTH TURBINE SITE C-3

SHEET NUMBER: C 5.4

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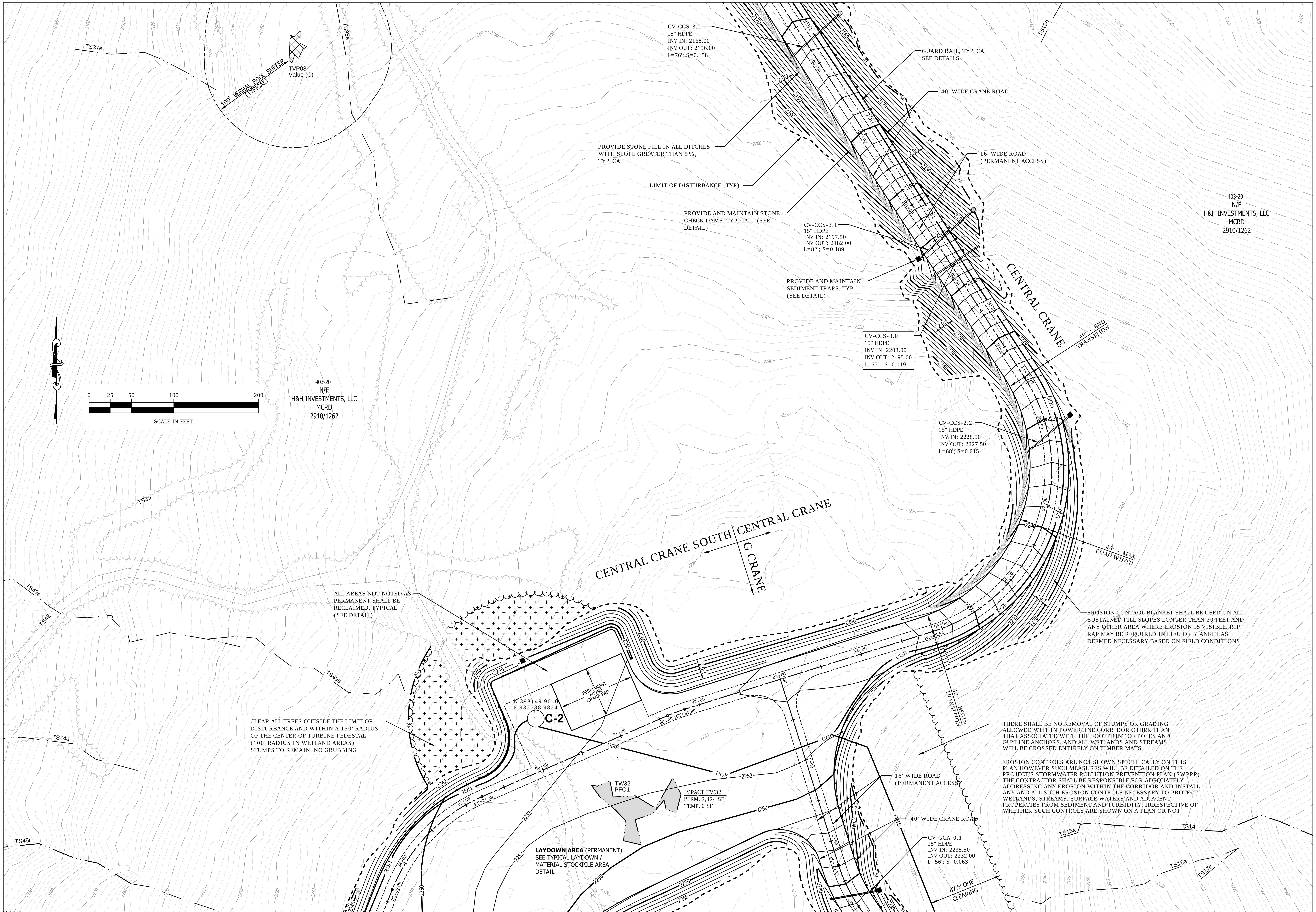

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MATCH LINE - SHEET C 7.1

(SEE PROFILE SHEETS: P 5.2 & P 7.1)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENG'D BY: JCD
DRAWN BY: JCD
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ARCHIVE #: H-5107

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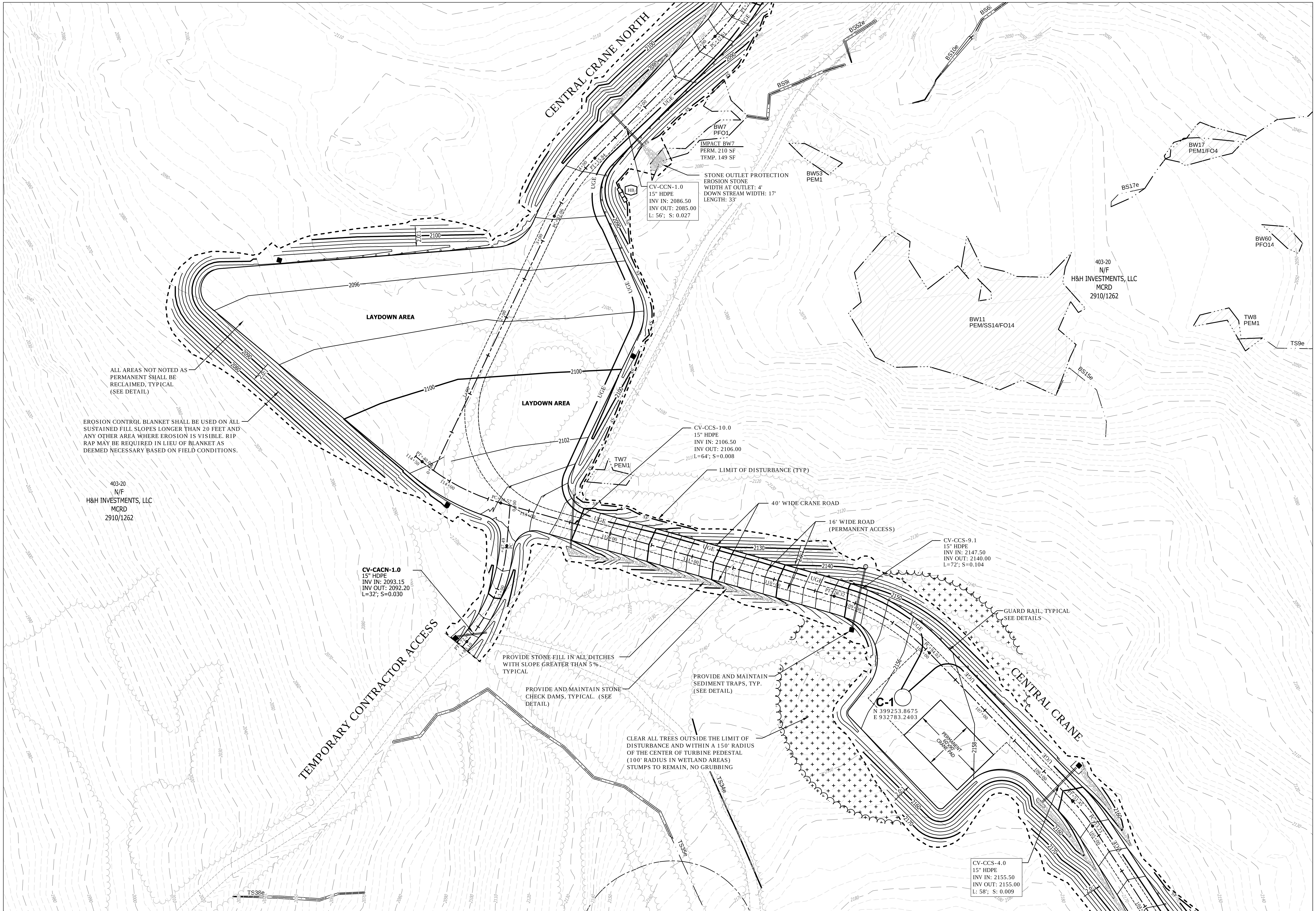
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
CENTRAL CRANE SOUTH
TURBINE SITE C-2
CENTRAL CRANE
G CRANE

SHEET NUMBER: C 5.5

MATCH LINE - SHEET C 6.1



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MATCH LINE - SHEET C 5.5 (SEE PROFILE SHEETS: P 5.2 & P 6.1)

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENG'D BY: JCD
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ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
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PROFESSIONAL ENGINEER
11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
CENTRAL CRANE
CENTRAL CRANE NORTH
TURBINE SITE C-1

SHEET NUMBER: C 5.6

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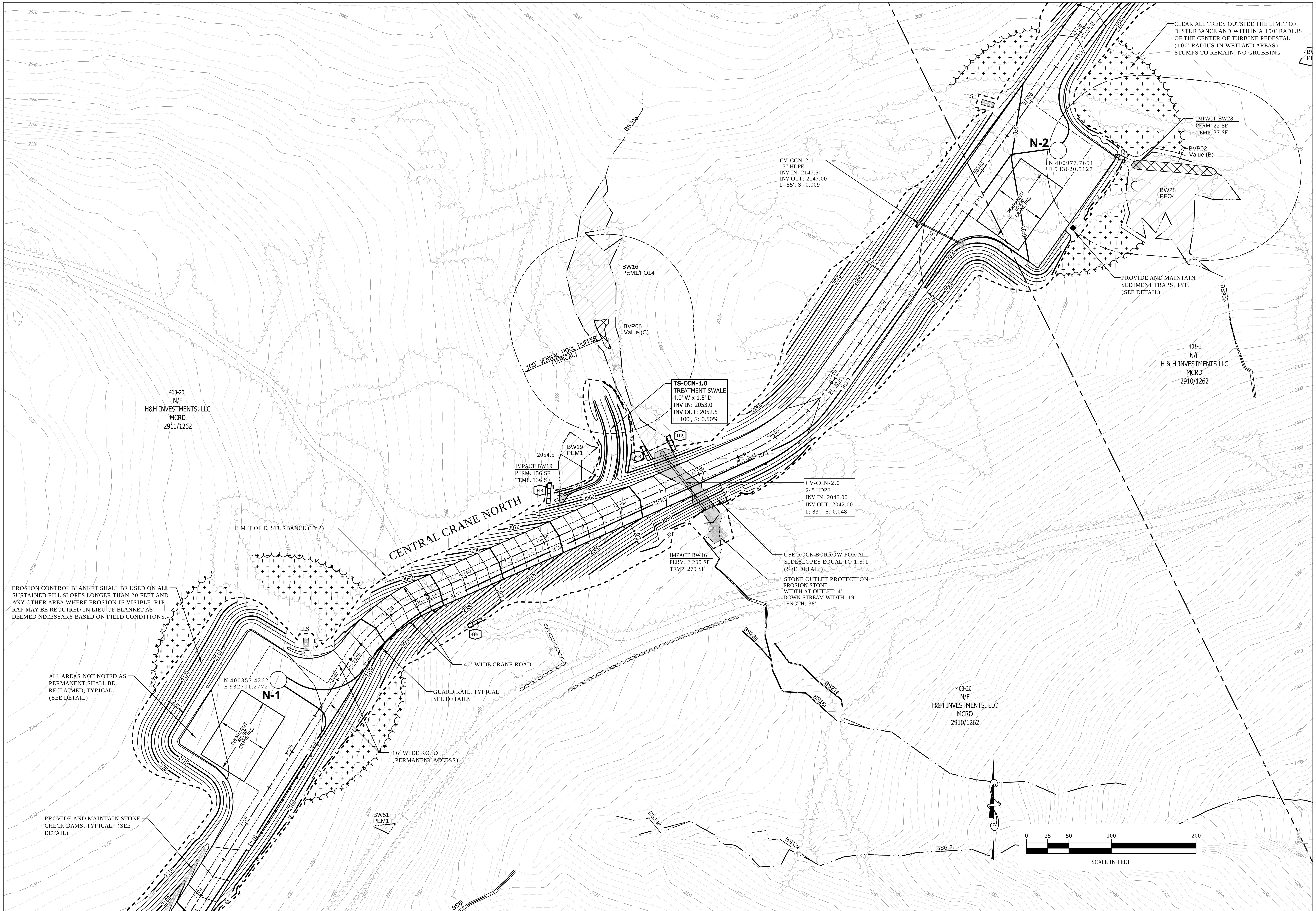

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MATCH LINE - SHEET C 5.6

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IBERDROLA RENEWABLES

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
CENTRAL CRANE NORTH
TURBINE SITES N-1 & N-2

SHEET NUMBER: C 6.1

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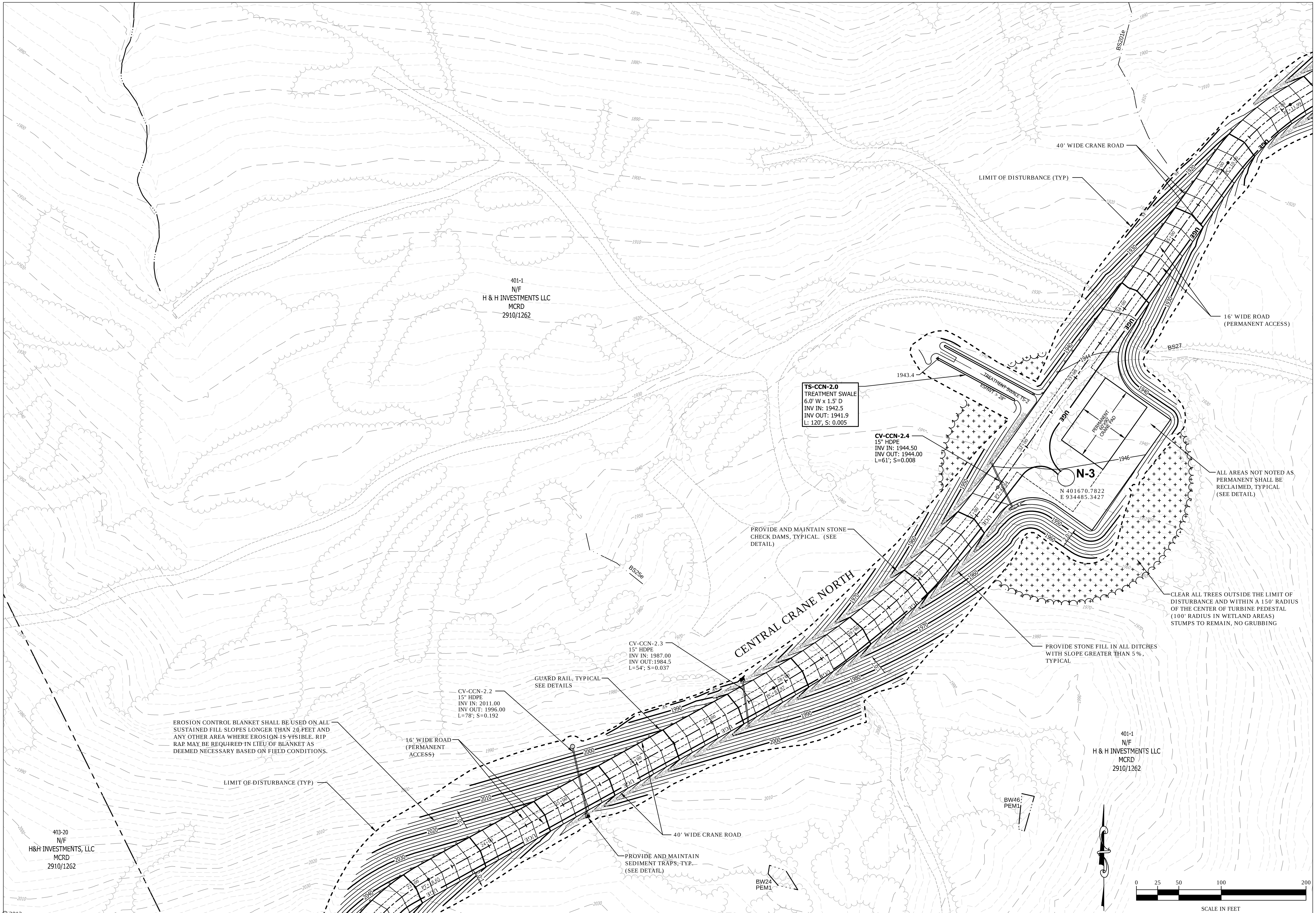

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STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 LICENSED PROFESSIONAL ENGINEER 11/21/13

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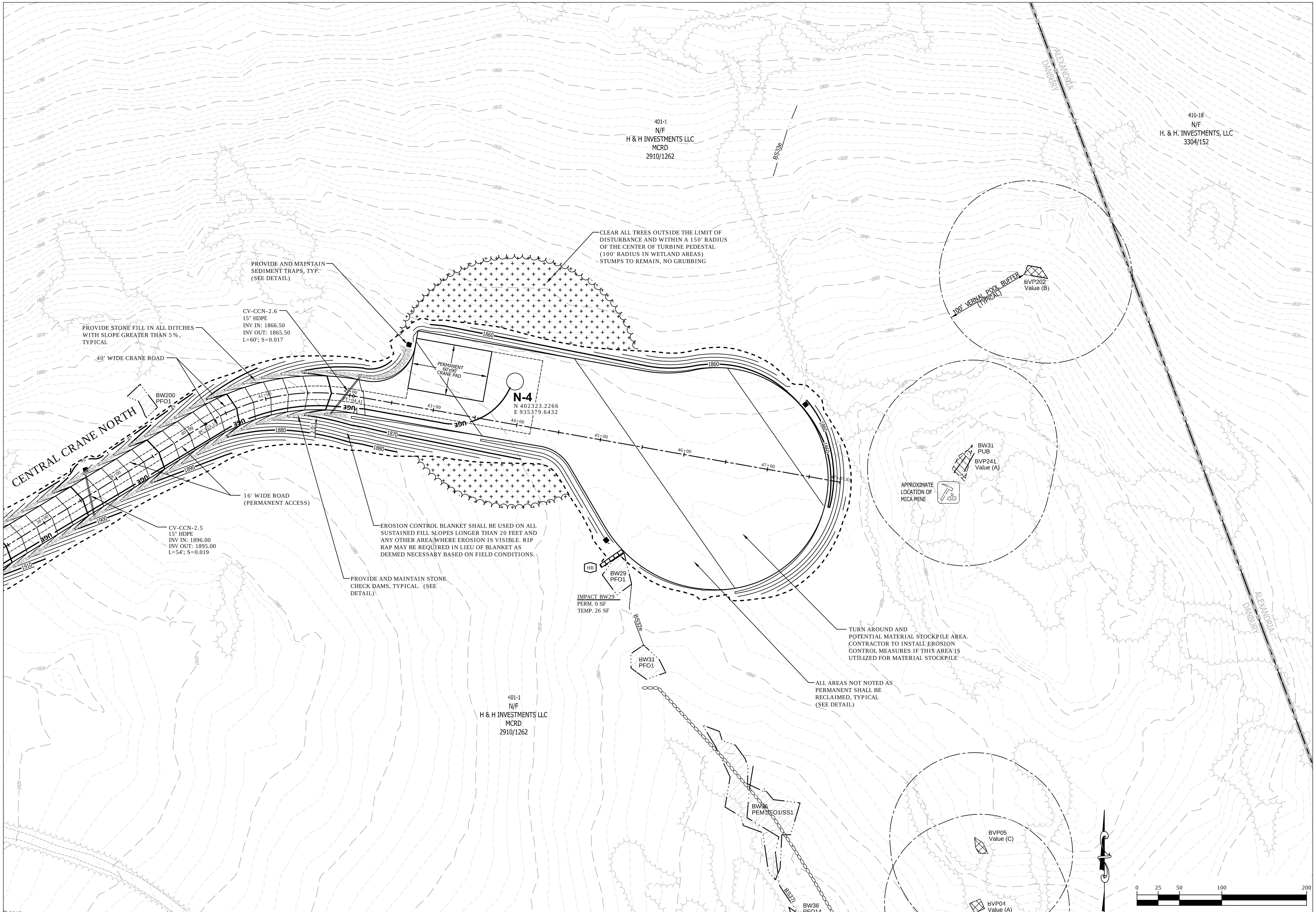
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL CRANE NORTH TURBINE SITE N-3

SHEET NUMBER: C 6.2



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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL CRANE NORTH TURBINE SITE N-4

SHEET NUMBER: C 6.3

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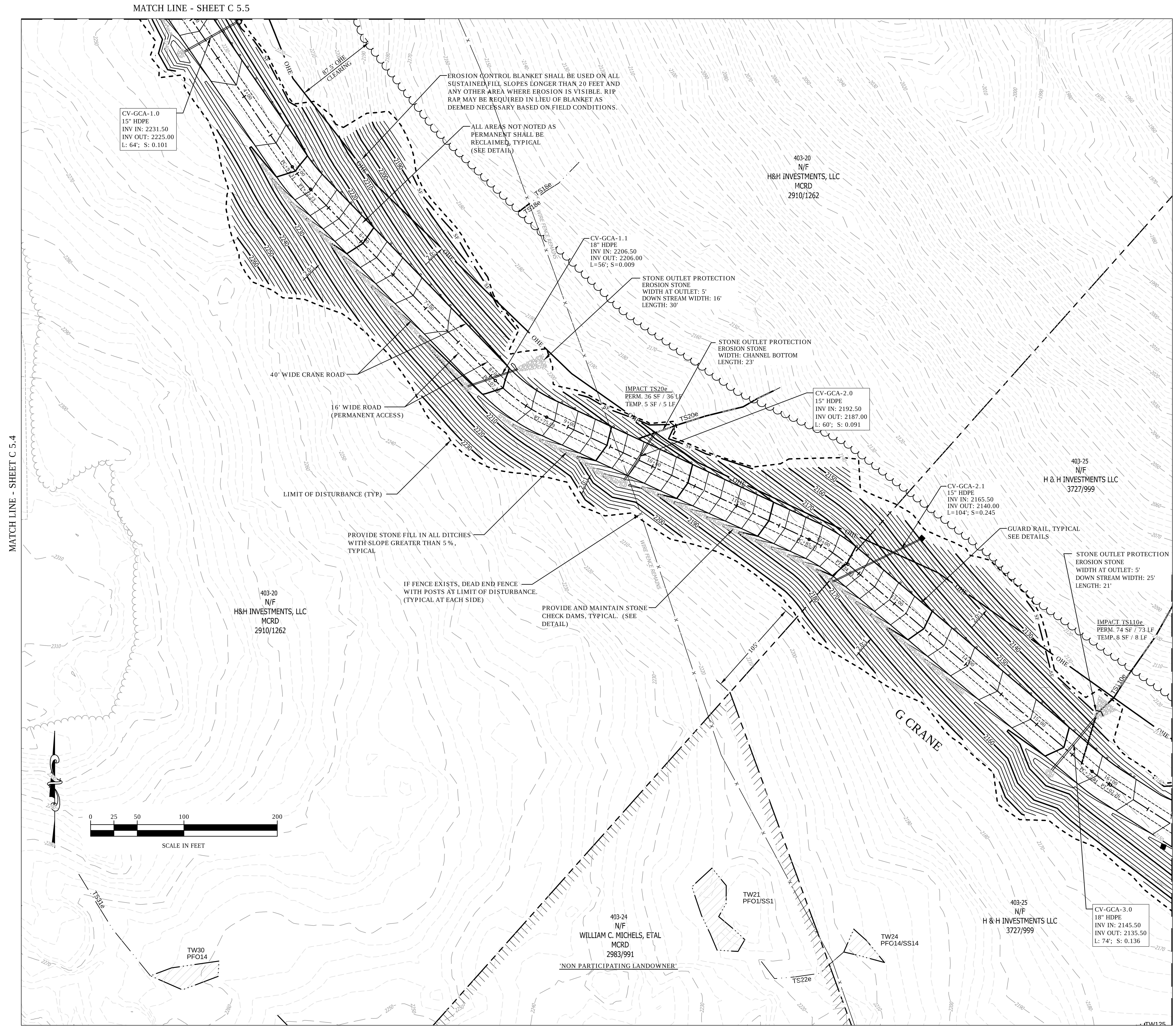

(SEE PROFILE SHEET: P 7.1)

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: G CRANE

SHEET NUMBER: C 7.1

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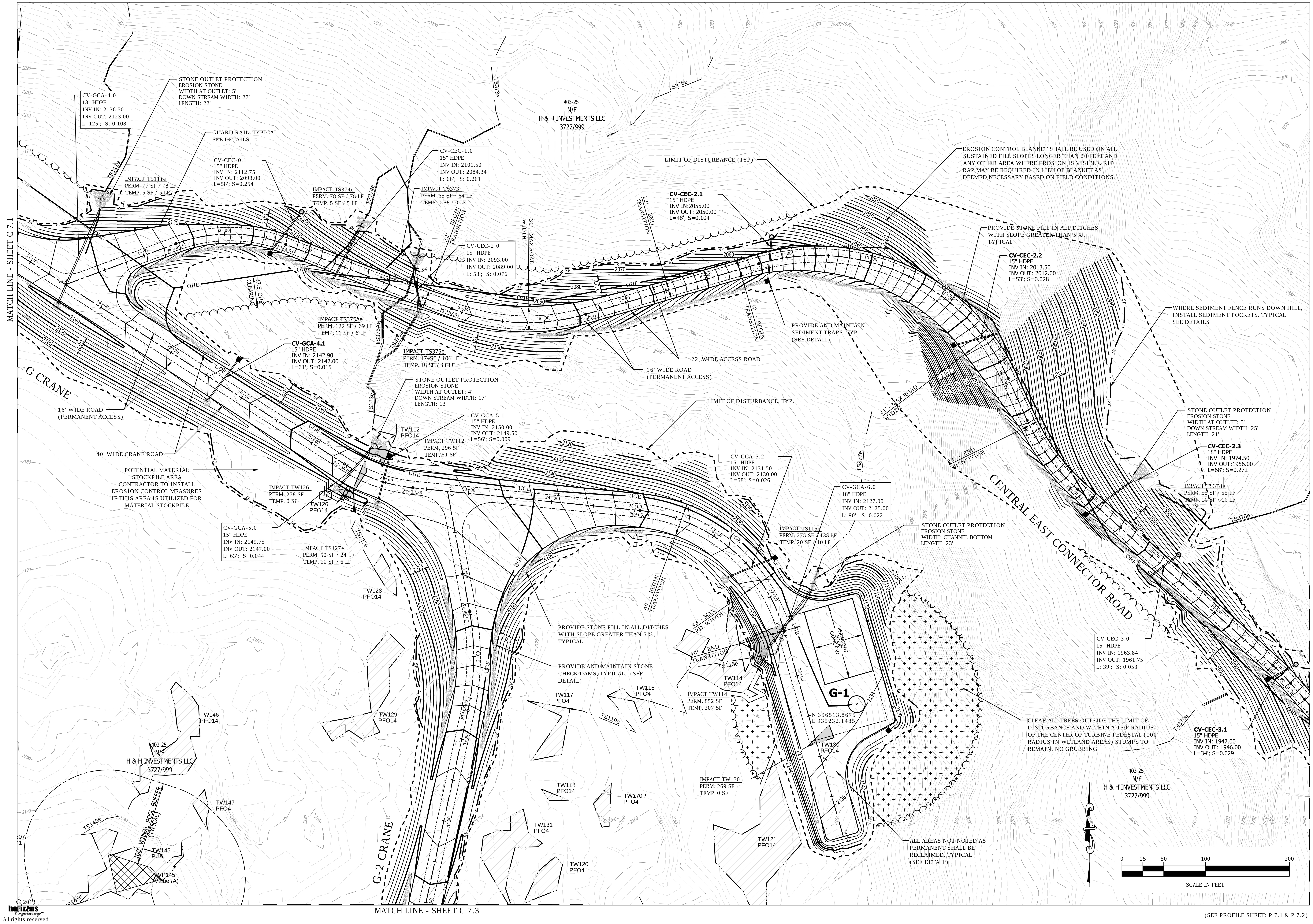

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(SEE PROFILE SHEET: P 7.1 & P 7.2)

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No. 13828
PROFESSIONAL ENGINEER
11/21/13

horizons Engineering inc
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
G CRANE
CENTRAL EAST CONNECT.
TURBINE SITE G-1
G-2 CRANE

SHEET NUMBER: C 7.2

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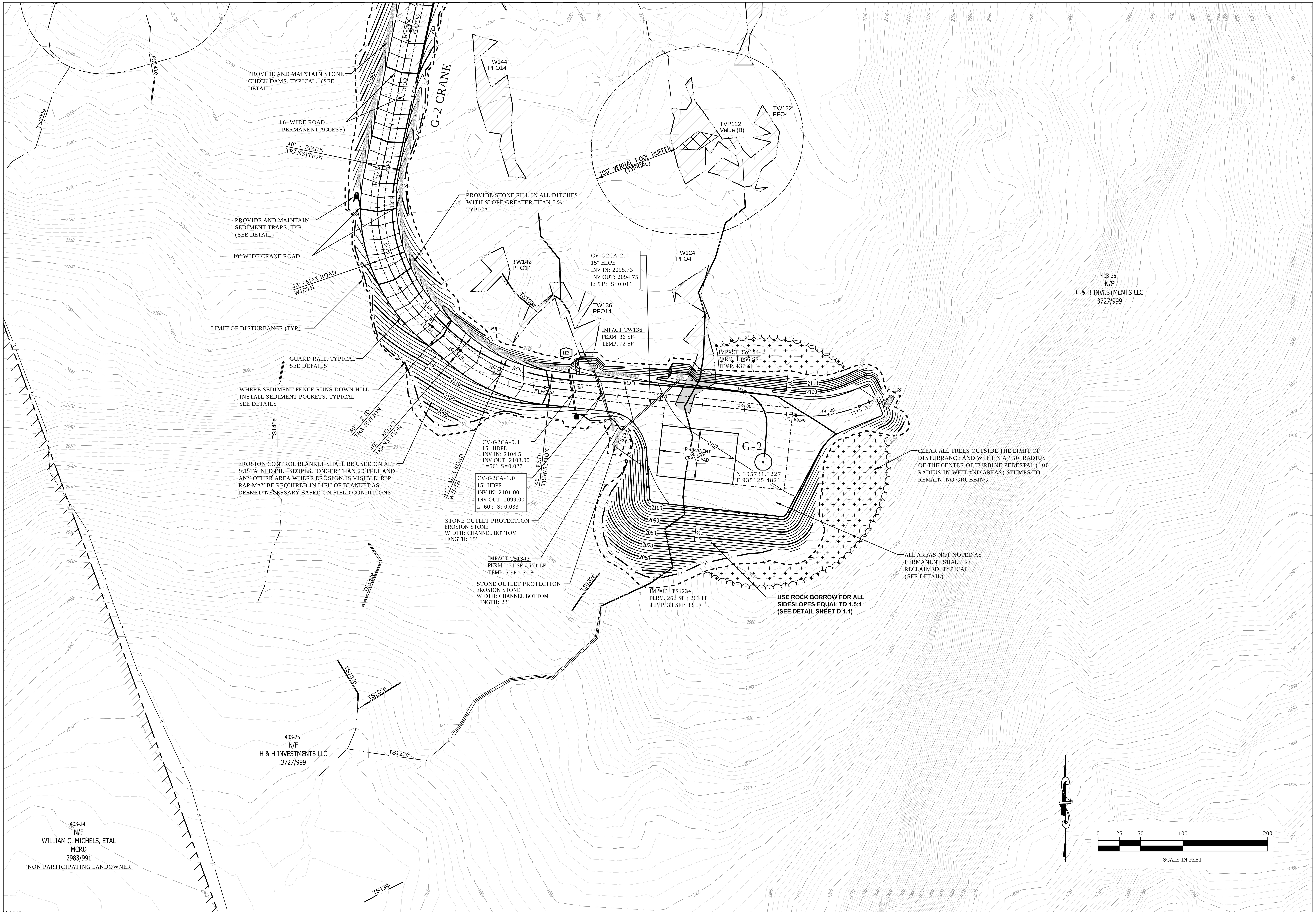

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(SEE PROFILE SHEET: P 7.1)

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENG'N'D BY: JCD
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STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13528 PROFESSIONAL ENGINEER 11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: G-2 CRANE
TURBINE SITE G-2

SHEET NUMBER: C 7.3

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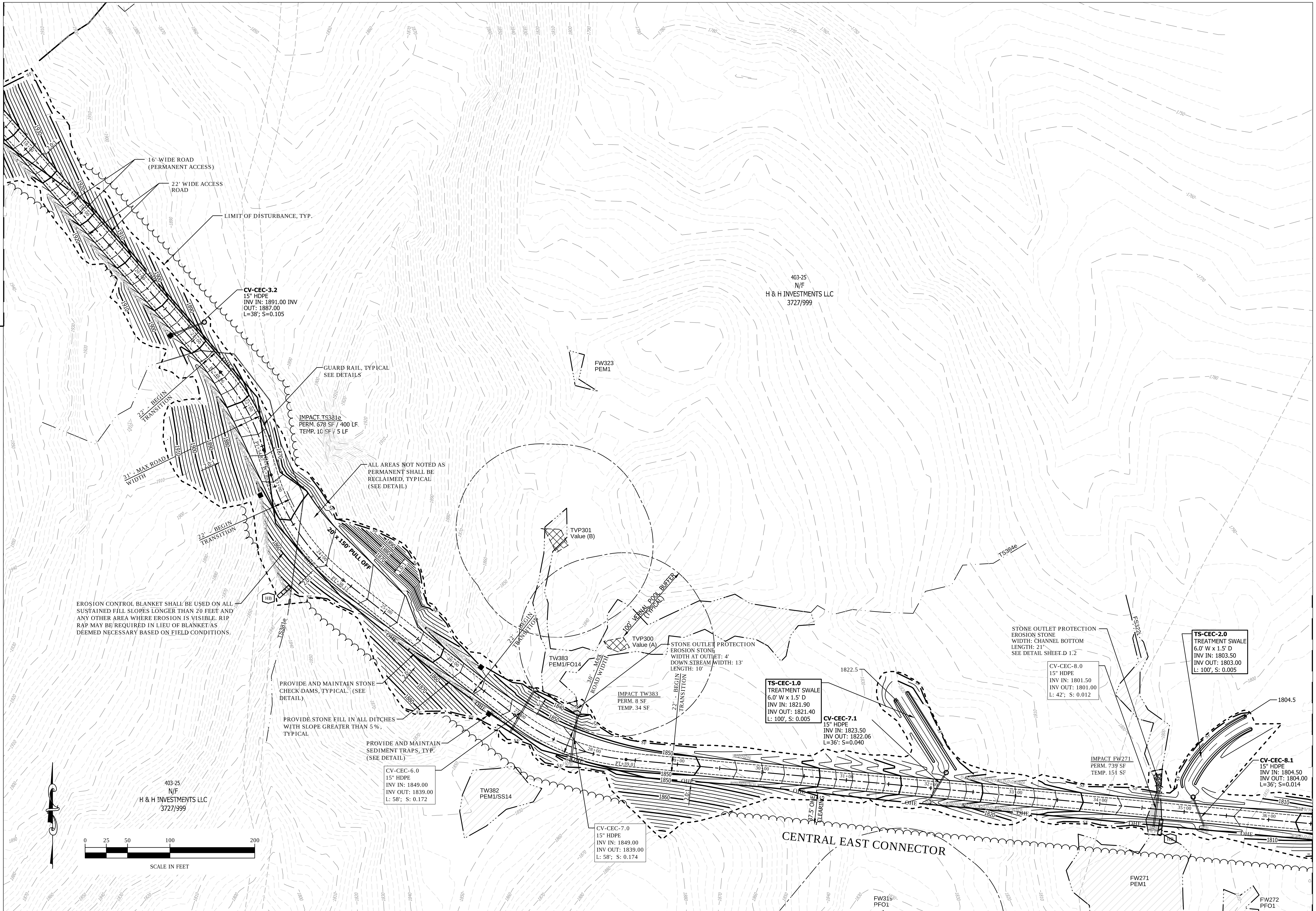

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENG'N'D BY: JCD
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STATE OF NEW HAMPSHIRE — ARTHUR JOHN COLVIN No. 13528 — LICENSED PROFESSIONAL ENGINEER — 11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL EAST CONNECTOR

SHEET NUMBER: C 7.4

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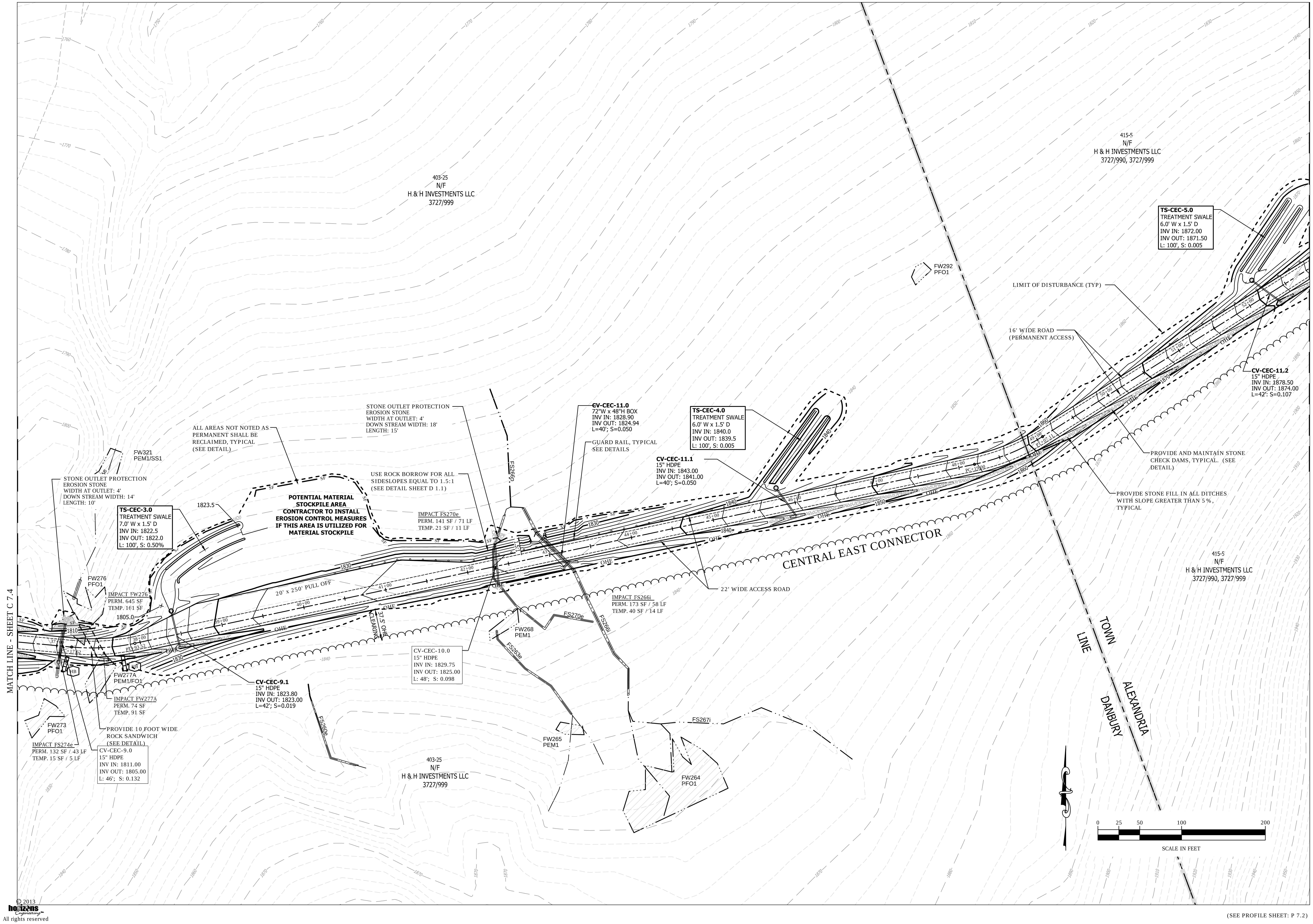

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(SEE PROFILE SHEET: P 7.2)

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: JCD
DRAWN BY: JCD
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No.13828 LICENSED PROFESSIONAL ENGINEER 11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH
70 PERCENT DESIGN

SHEET TITLE: CENTRAL EAST CONNECTOR

SHEET NUMBER: C 7.5

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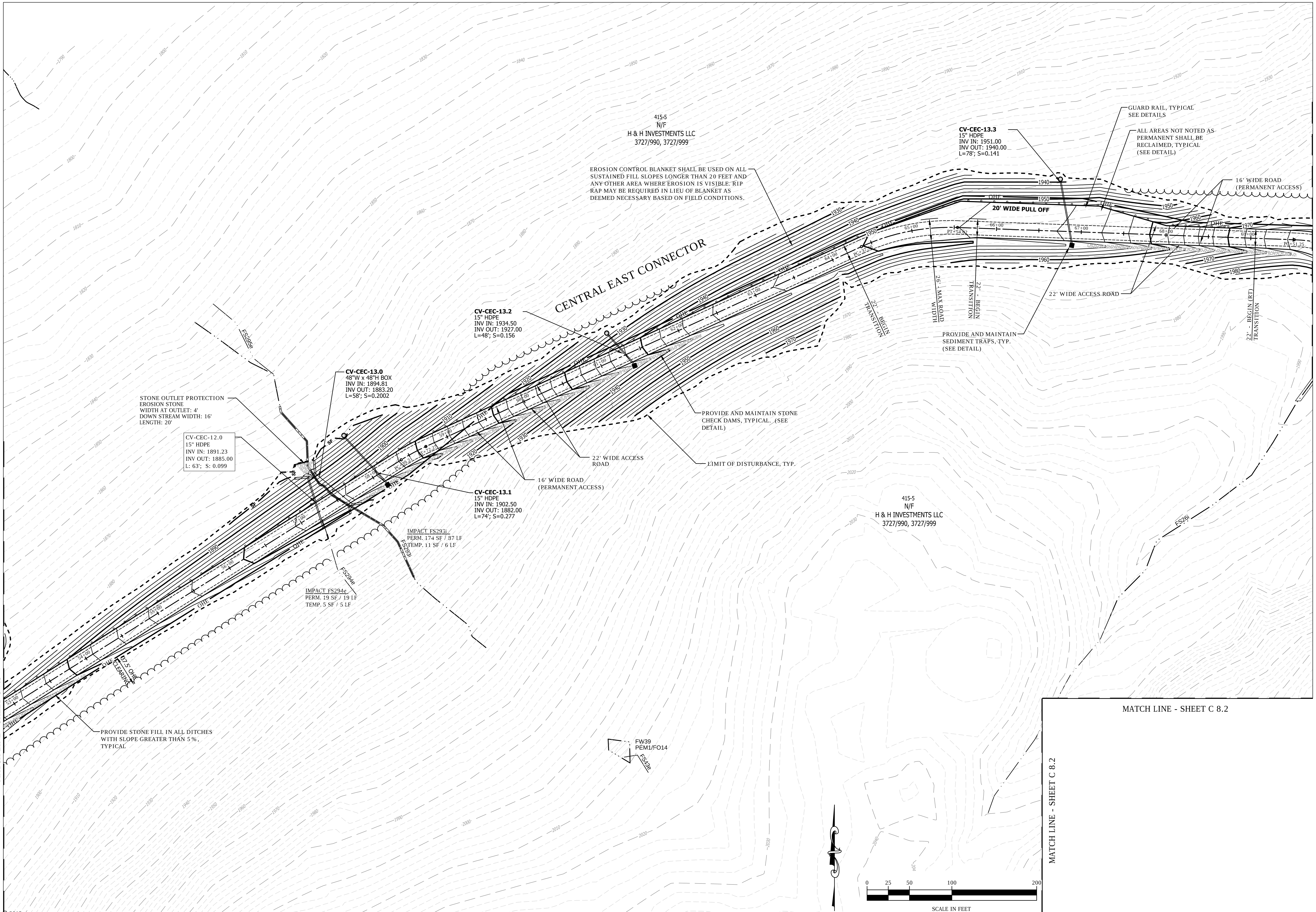

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NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
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DRAWN BY:	JCD
CHECK'D BY:	AJC
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STATE OF NEW HAMPSHIRE
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No. 13528
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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL EAST CONNECTOR

SHEET NUMBER: C 7.6

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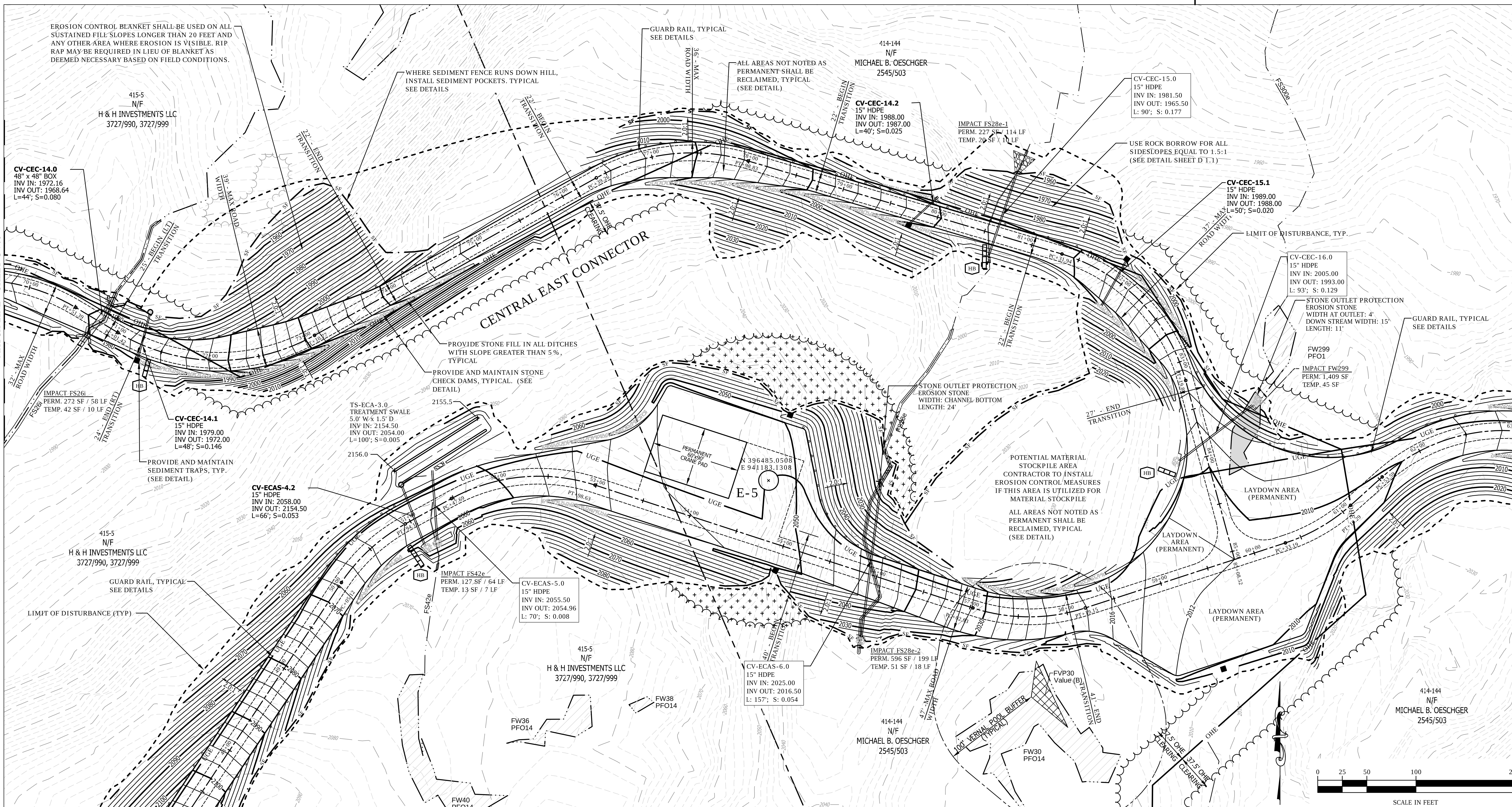

(SEE PROFILE SHEETS: P 7.3, P 8.1 & P 8.2)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
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DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL EAST CONNECTOR TURBINE SITE E-5 EAST CRANE ROADS

SHEET NUMBER: C 7.7

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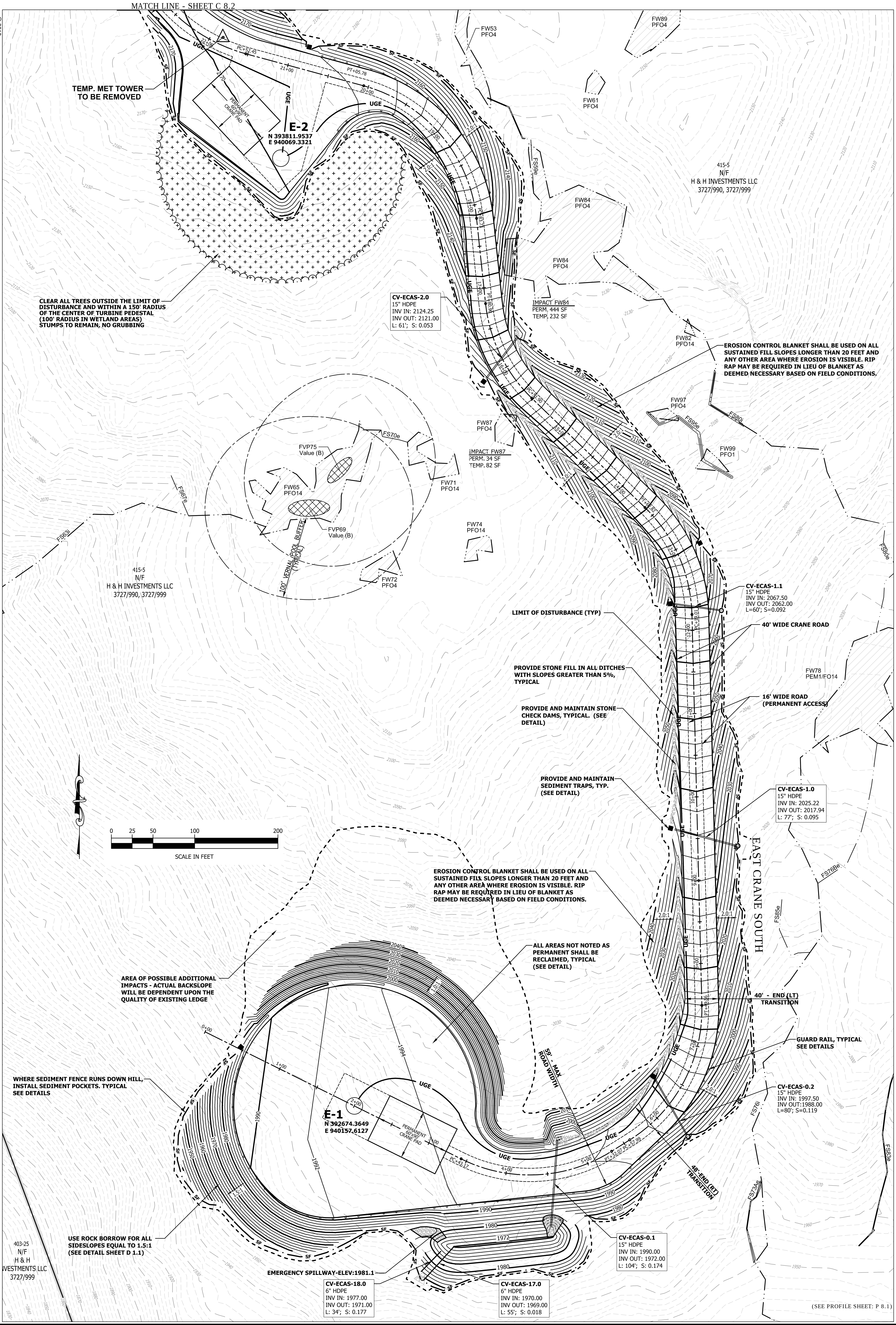

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SHEET TITLE:
EAST CRANE SOUTH
TURBINE SITES E-1 & E-2

SHEET NUMBER: C 8.1

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

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11/27/13

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	DEB
DRAWN BY:	DEB
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

IBERDROLA RENEWABLES

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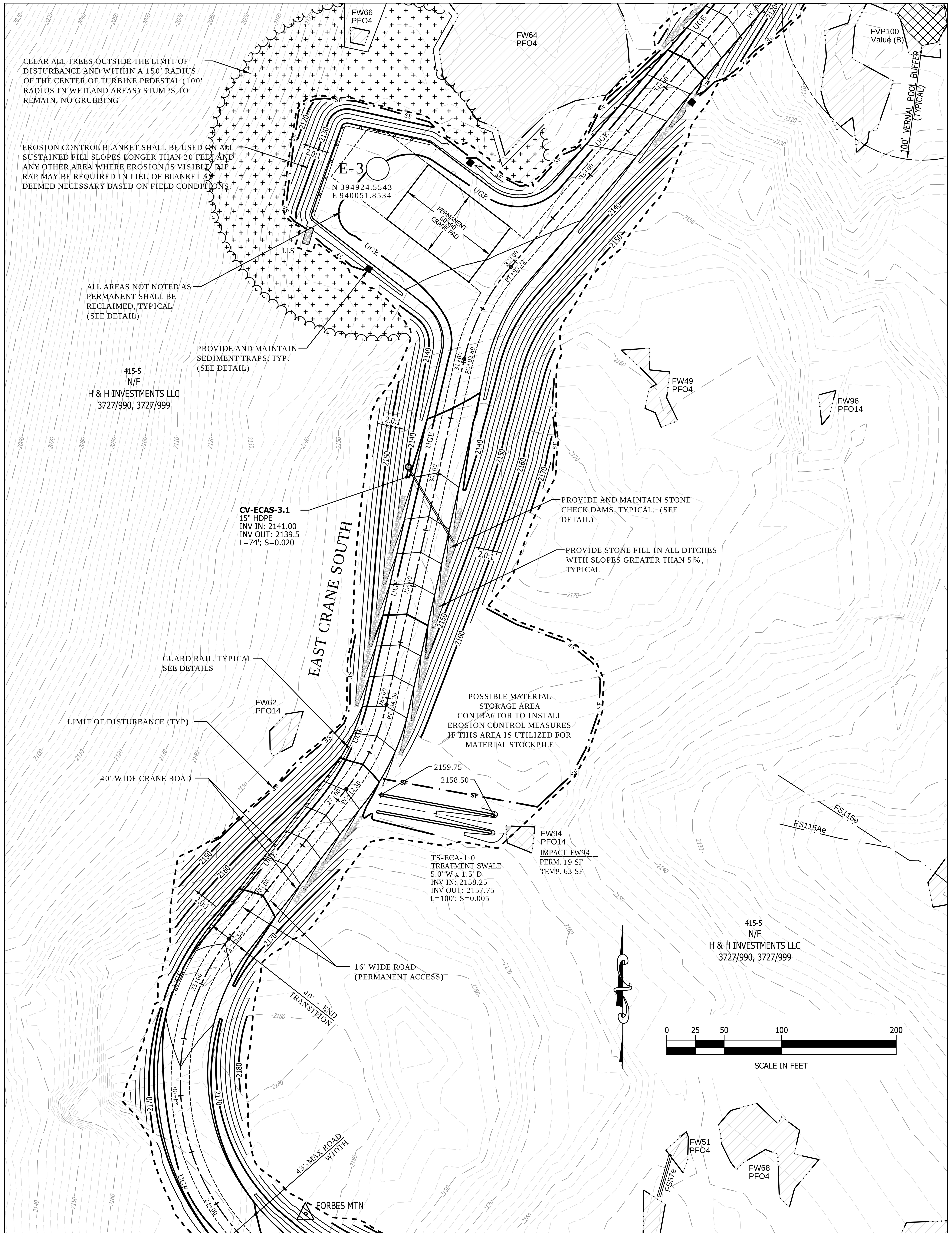

MATCH LINE - SHEET C 8.1

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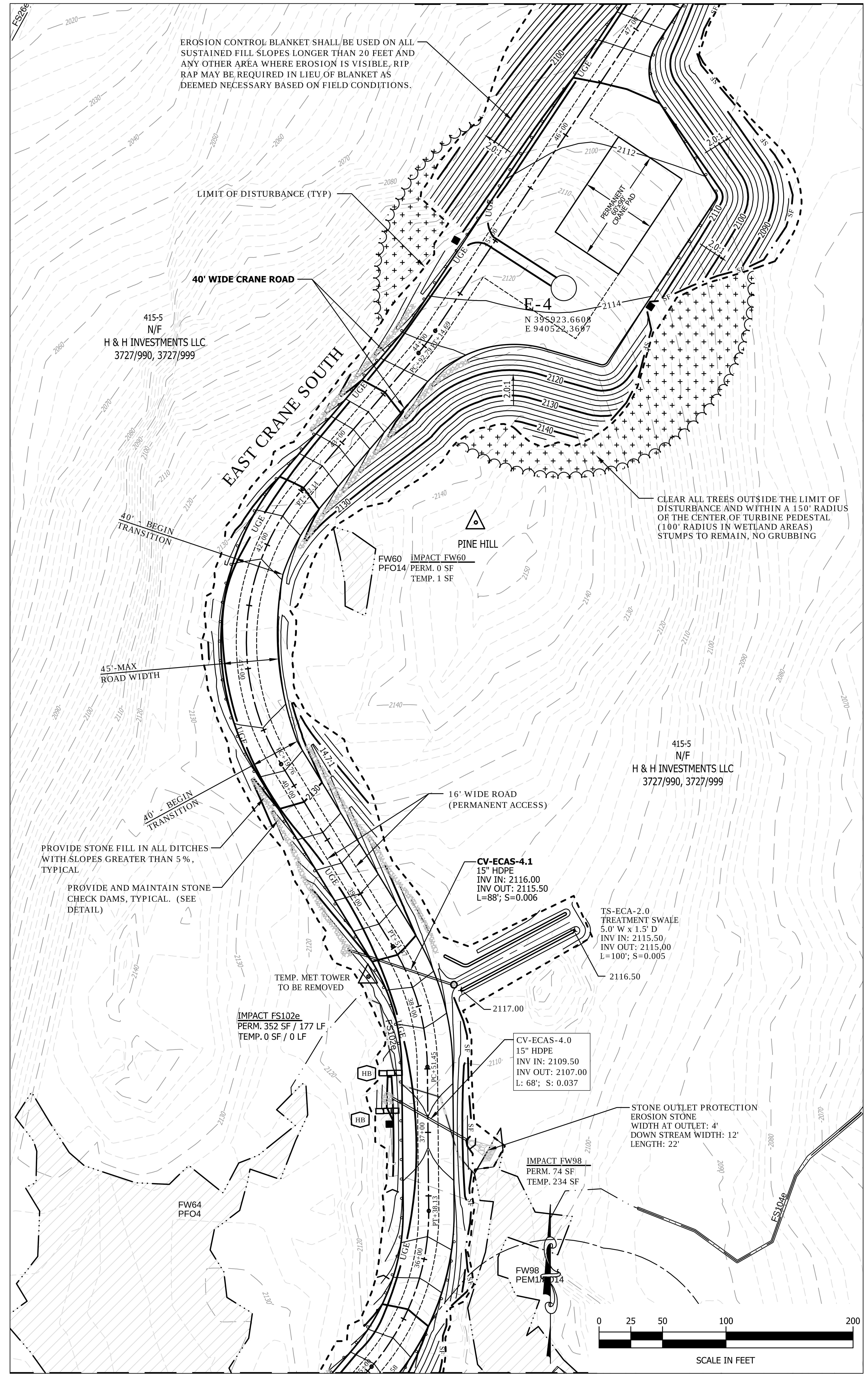
MATCH LINE - SHEET C 7.7



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(SEE PROFILE SHEET: P 8.1)

IBERDROLA RENEWABLES

NO	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: DEB
DRAWN BY: DEB
CHECK'D BY: AJC
ARCHIVE #: H-5107

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
EAST CRANE SOUTH
TURBINE SITES E-3 & E-4

SHEET NUMBER: C 8.2

P:\13185 IRF\21\DWGS\70 Percent\cstE-70.dwg, ECS C8.2, 11/22/2013 8:31:50 AM, KRPhilbrick

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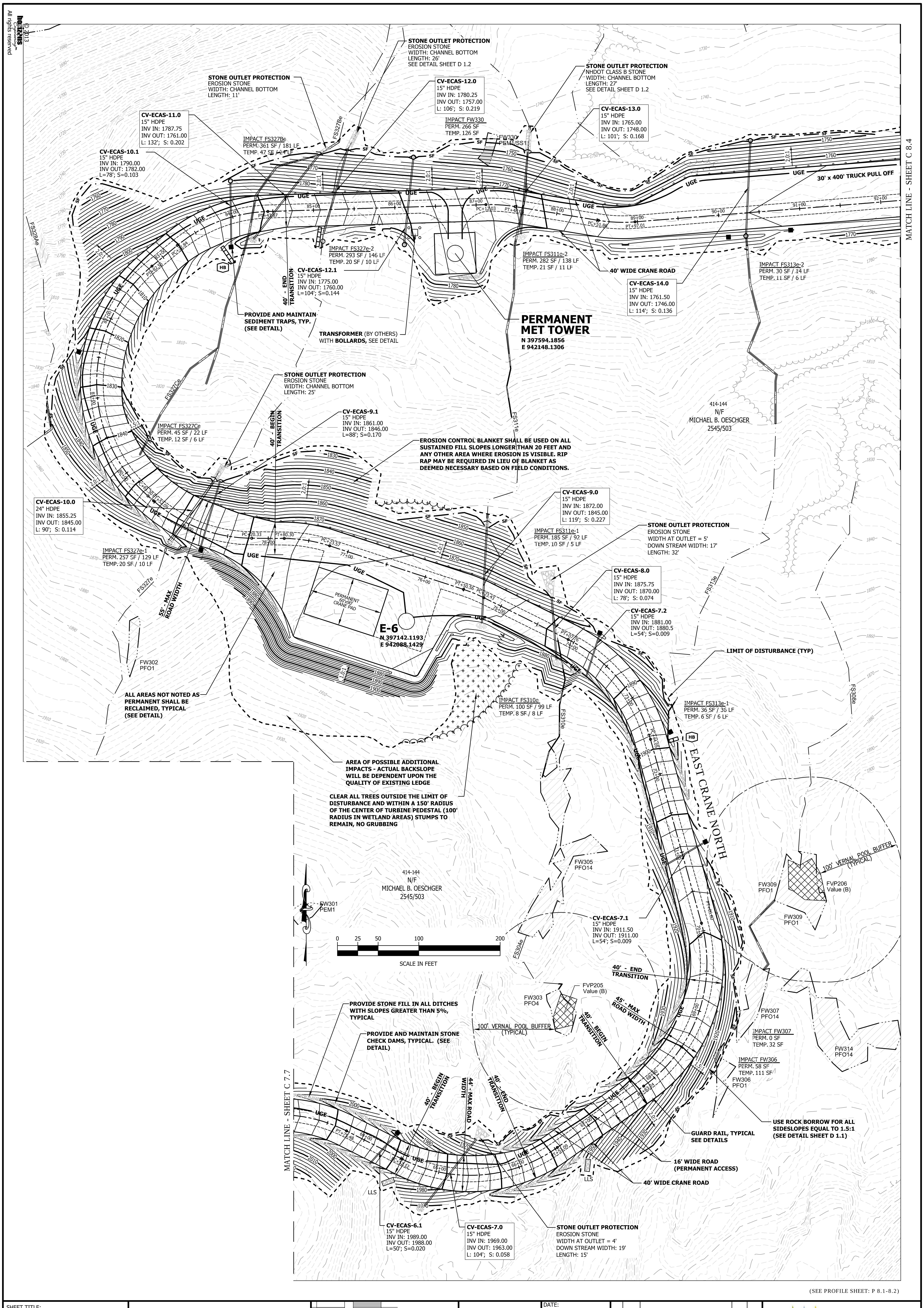

(SEE PROFILE SHEET: P 8.1-8.2)

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SHEET TITLE:				
EAST CRANE NORTH TURBINE SITE E-6 MET TOWER SITE	**WILD MEADOWS WIND PROJECT** ALEXANDRIA AND DANBURY, NH 70 PERCENT DESIGN	horizons Engineering Inc 34 School Street Littleton, NH 03561 Phone 603.444.4111 - Fax 603.444.1343	STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 PROFESSIONAL ENGINEER 11/21/13	IBERDROLA RENEWABLES
SHEET NUMBER: C 8.3				

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	DEB
DRAWN BY:	DEB
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

(SEE PROFILE SHEET: P 8.2)

SHEET TITLE: EAST CRANE NORTH TURBINE SITES E-7 & E-8	WILD MEADOWS WIND PROJECT ALEXANDRIA AND DANBURY, NH 70 PERCENT DESIGN
SHEET NUMBER: C 8.4	

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11/21/13

DATE:	NOVEMBER 2013
PROJECT #:	13185
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ARCHIVE #:	H-5107

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

IBERDROLA RENEWABLES

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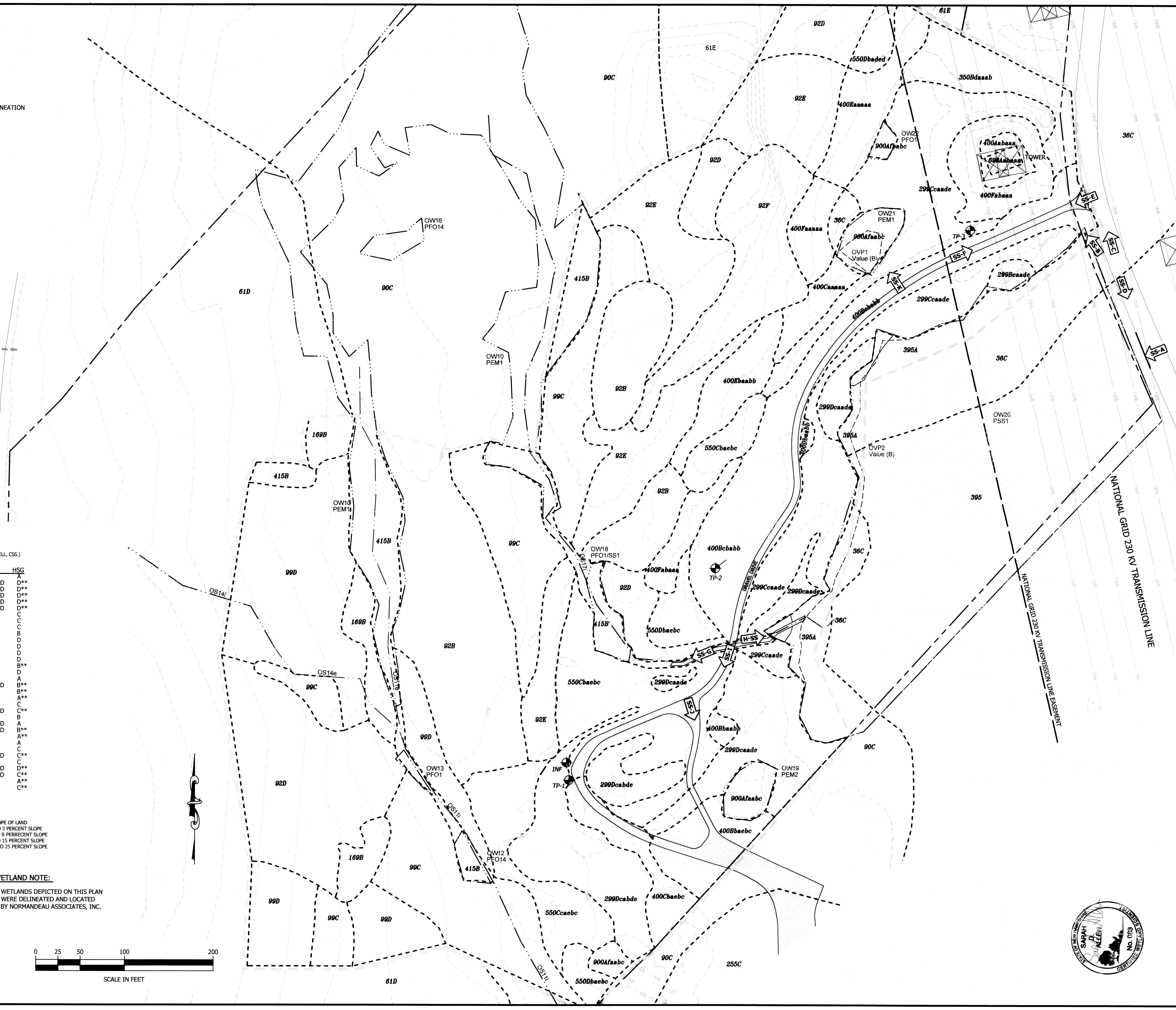
LEGEND

- SOIL BOUNDARY
- 647B — SOIL CLASSIFICATION
- LIMIT OF SITE SPECIFIC SOIL DELINEATION
- OM-A — PHOTO LOCATION & ID
- TP #1 — TEST PIT LOCATION & ID
- INF — INFILTRATION TEST LOCATION
- STREAM
- WETLAND BOUNDARY
- TW270 PEM1/FO14 — WETLAND CLASSIFICATION
- VERNAL POOL



SITE-SPECIFIC SOILS INFORMATION

(USED WITHIN THE AREA OF PROPOSED DEVELOPMENT, AS DELINEATED BY RAYMOND LOBDELL, CSS.)

MAPPING UNIT	SOIL TYPE(S)	DRAINAGE CLASS	HSG
36C	ADAMS	EXCESSIVELY DRAINED	A
92B	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92C	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92D	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92E	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92F	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
99B	TUNBRIDGE VERY STONY	WELL DRAINED	C
99C	TUNBRIDGE VERY STONY	WELL DRAINED	C
99D	TUNBRIDGE VERY STONY	WELL DRAINED	C
169B	SUNAPEE VERY STONY	MODERATELY WELL DRAINED	B
299Bcaade	UDORTHENTS	WELL DRAINED	D
299Ccaade	UDORTHENTS	WELL DRAINED	D
299Dcabde	UDORTHENTS	WELL DRAINED	D
299Dcaade	UDORTHENTS	WELL DRAINED	D
350Bdaaab	UDORTHENTS	MODERATELY WELL DRAINED	B**
395A	CHOCORUA	VERY POORLY DRAINED	D
400Aabaaa	UDORTHENTS	EXCESSIVELY DRAINED	A
400Bbaabb	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	B**
400Bcbabb	UDORTHENTS	WELL DRAINED	B**
400Caaaaa	UDORTHENTS	EXCESSIVELY DRAINED	A**
400Bbaebc	UDORTHENTS	EXCESSIVELY DRAINED	C
400Cbaebc	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	C**
400Dbaabb	UDORTHENTS	EXCESSIVELY DRAINED	B
400Eaaaaa	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	A
400Ebaabb	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	B**
400Fabaaa	UDORTHENTS	EXCESSIVELY DRAINED	A**
400Faaaaa	UDORTHENTS	EXCESSIVELY DRAINED	A
415B	MOOSILAUKE VERY STONY	POORLY DRAINED	C
500Cbaebc	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	C**
550Ccaebc	UDORTHENTS	WELL DRAINED	C
550Dbaded	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	D**
550Dbaebc	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	C**
699Aabaa	URBAN LAND	EXCESSIVELY DRAINED	A**
900Afaabc	DORTHENTS	POORLY DRAINED	C**

670 D

INDICATES SOIL NAME — 670

INDICATES SLOPE OF LAND — D
- A = 0 TO 3 PERCENT SLOPE
- B = 3 TO 8 PERRECENT SLOPE
- C = 8 TO 15 PERCENT SLOPE
- D = 15 TO 25 PERCENT SLOPE

SITE-SPECIFIC SOILS NOTES

1. THIS DETAILED SITE SPECIFIC SOIL MAP CONFIRMS TO THE STANDARDS OF SSSNNE PUBLICATIONS NO.3, AS AMENDED, "SITE-SPECIFIC SOIL MAPPING STANDARDS FOR NH AND VT"
2. MAPPING COMPLETED IN DECEMBER 2012 BY RAYMOND LOBDELL, CSS.
3. SEE ACCOMPANYING NARRATIVE REPORT FOR METHODOLOGY, MAP SYMBOL LEGEND, AND INTERPRETATIONS. THIS MAP WAS COMPLETED TO CONFORM TO THE REQUIREMENTS OF THE NHDES, AOT RULES.

WETLAND NOTE:

1. WETLANDS DEPICTED ON THIS PLAN WERE DELINEATED AND LOCATED BY NORMANDEAU ASSOCIATES, INC.

0 25 50 100 200

SCALE IN FEET

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P:\13185 IRF12\DWGS\70 Percent\DES_SubStation70 drainage.dwg, EX-COND, 11/7/2013 1:32:45 PM

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 7, 2013
PROJECT #:	13185
ENGIN'D BY:	RL
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CHECK'D BY:	AJC
ARCHIVE #:	H-5107

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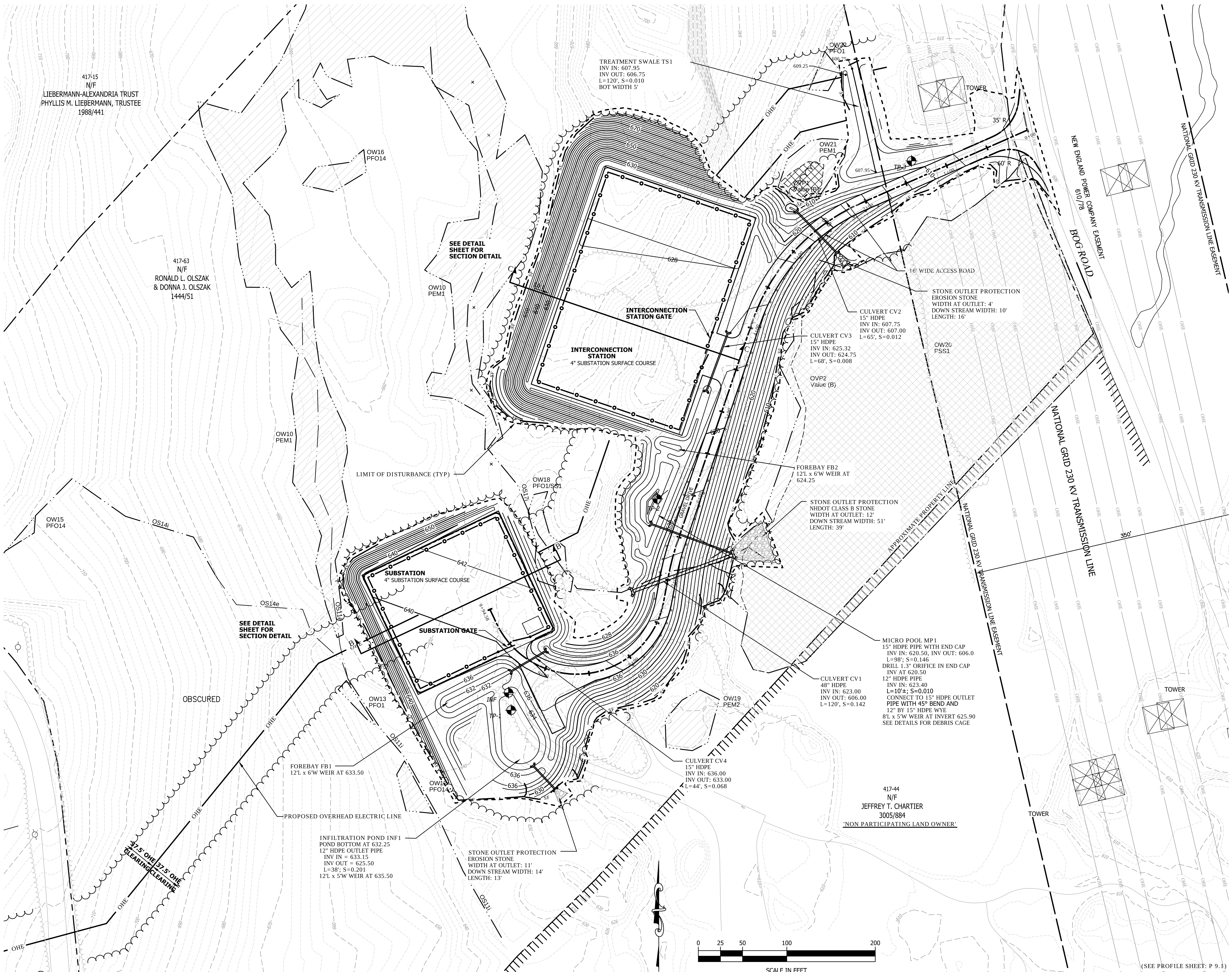
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

SHEET TITLE: SUBSTATION & INTERCONNECECTION STATION EXISTING CONDITIONS

SHEET NUMBER: C 9.1 Ex



(SEE PROFILE SHEET: P 9.1)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGN'D BY:	AJC
DRAWN BY:	AJC
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ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE
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No. 13528
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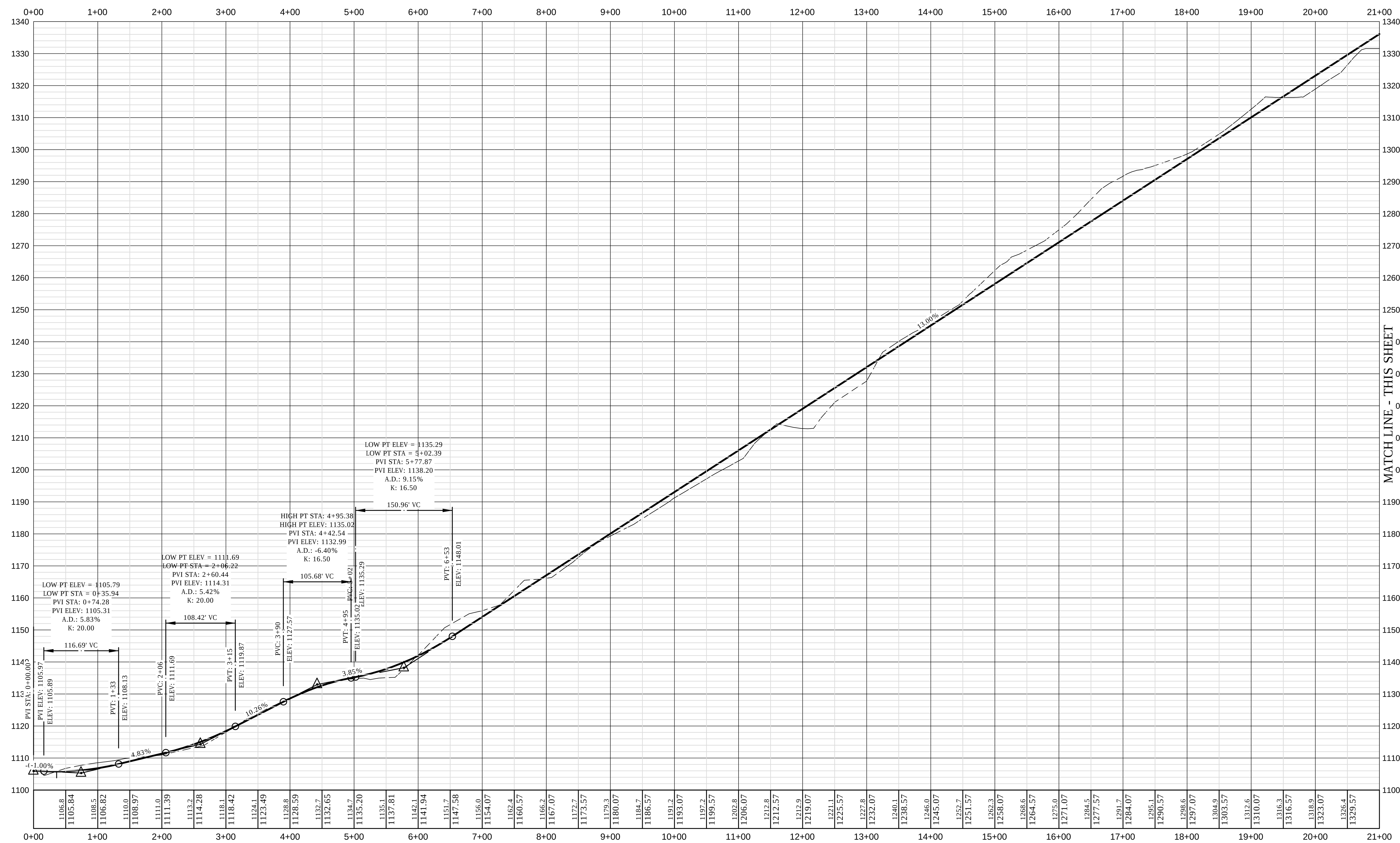
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

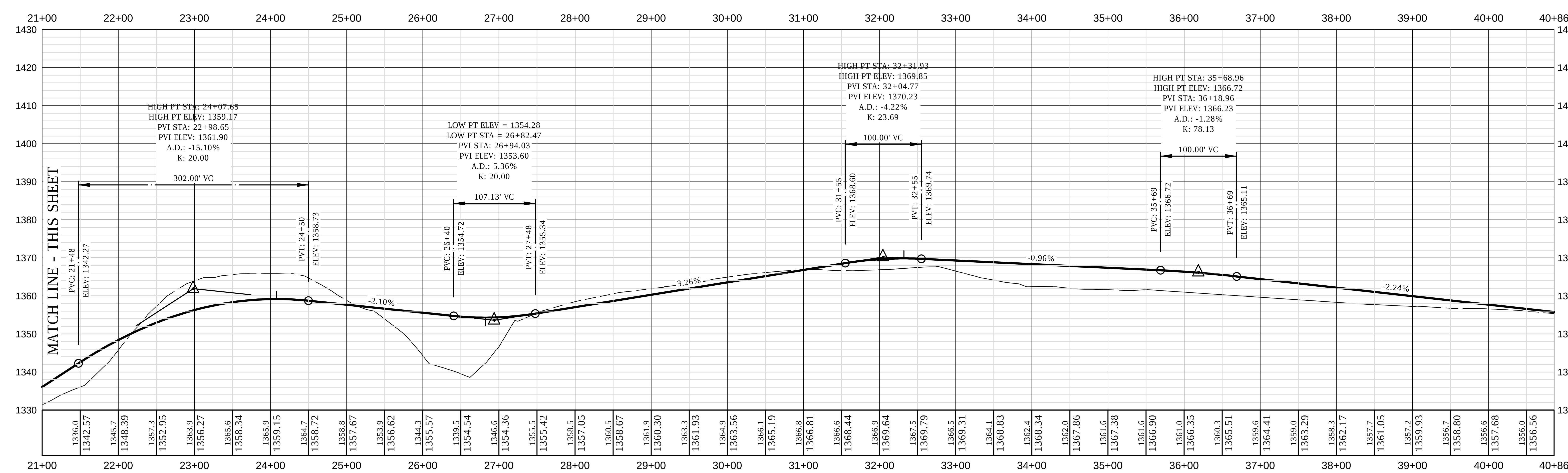
SHEET TITLE:
SUBSTATION & INTERCONNECECTION STATION SITE PLAN

SHEET NUMBER: C 9.1



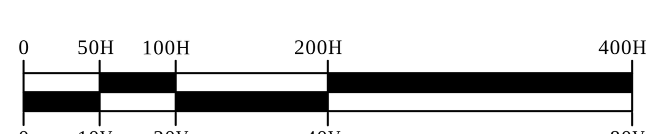
SITE ACCESS ROAD (WMAC1.2)

STA: 0+00 to STA: 21+00



SITE ACCESS ROAD (WMAC1.2)

STA: 21+00 to STA: 40+86



(SEE SITE SHEETS: C 2.1, C 2.2, C 3.1 & C 3.2)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG
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0				
0				
0				
0				

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: JCD
DRAWN BY: JCD
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 LICENSED PROFESSIONAL ENGINEER 12/3/13

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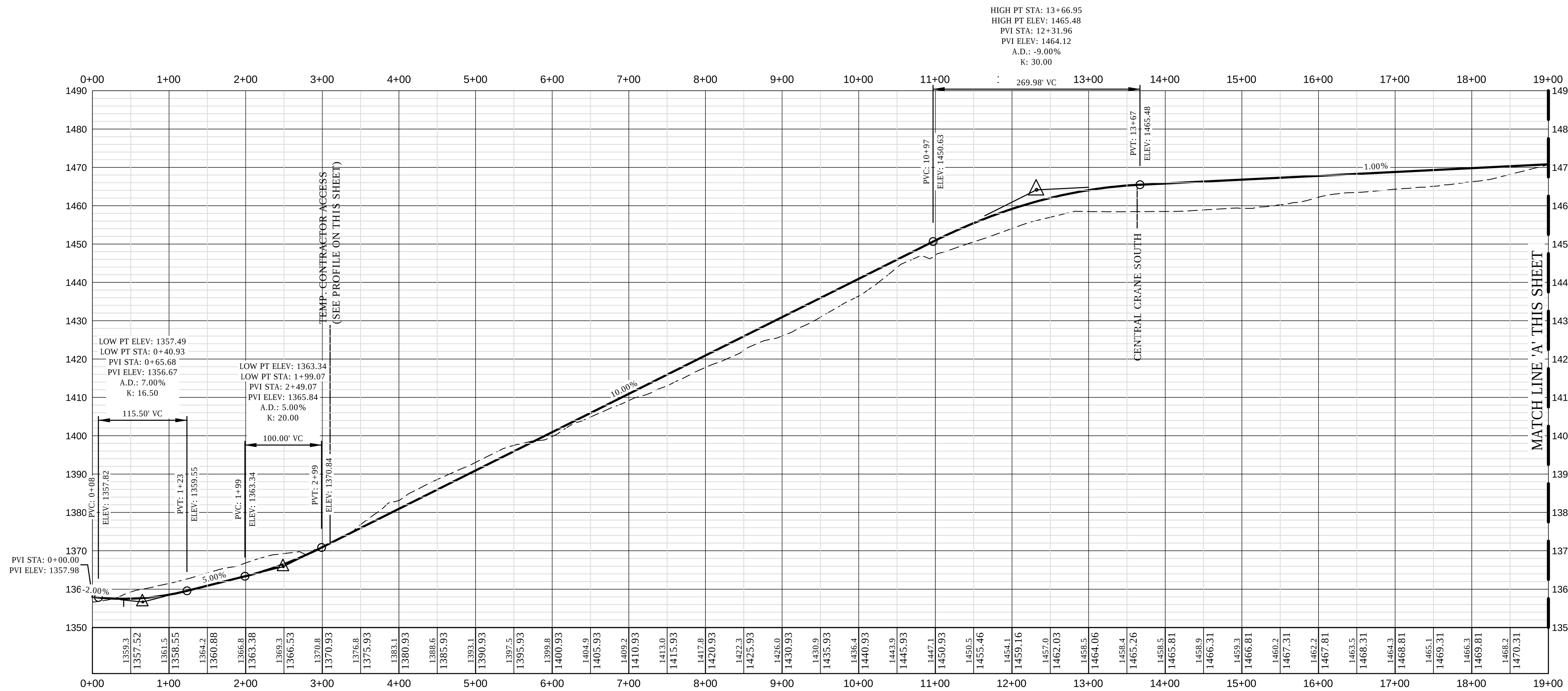
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: SITE ACCESS

SHEET NUMBER: P 2.1



CENTRAL ACCESS SOUTH (CAS)
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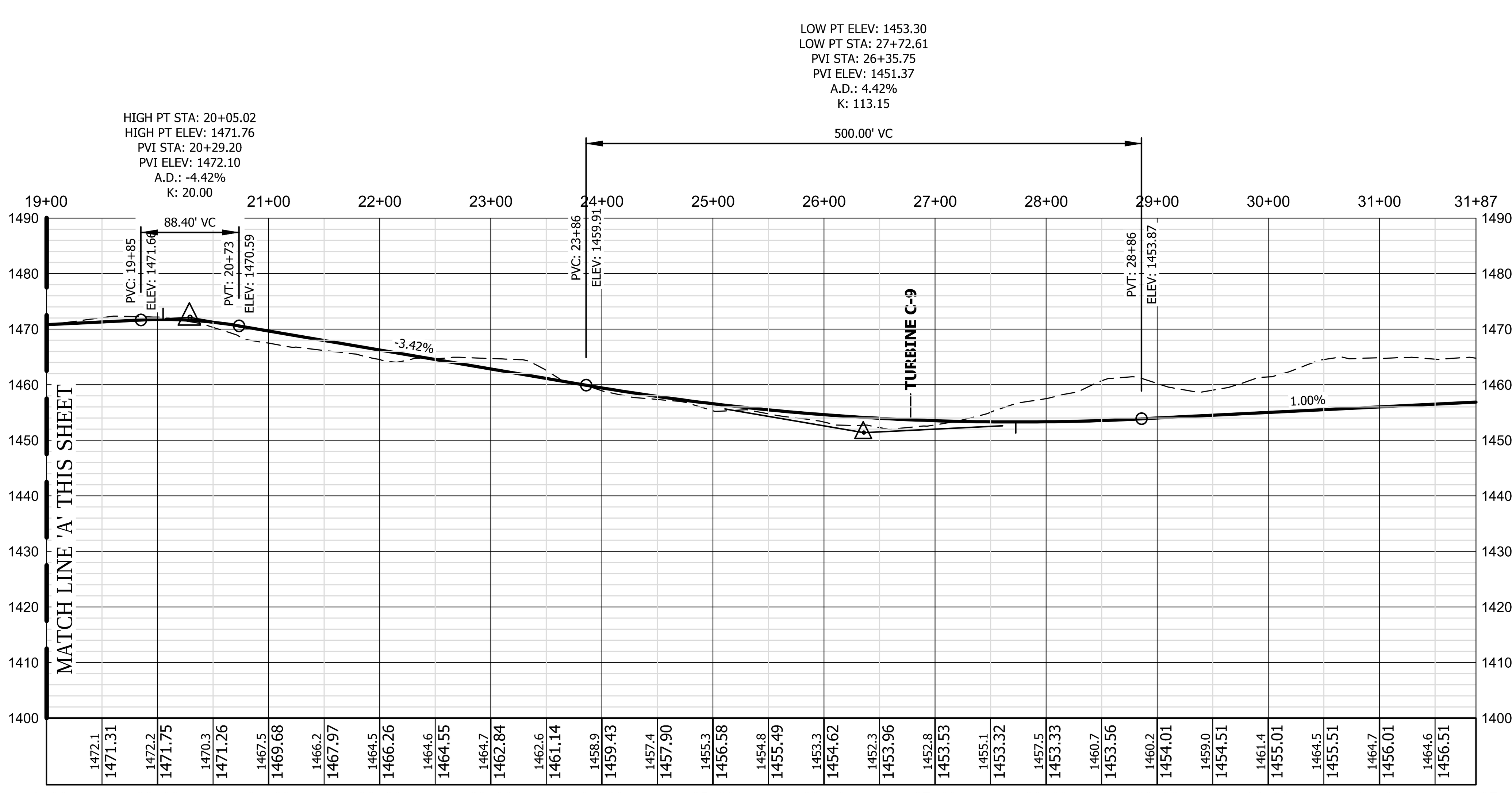
(SEE PLAN SHEETS: C 3.2 & C 3.3)



CENTRAL ACCESS SOUTH (CAS)
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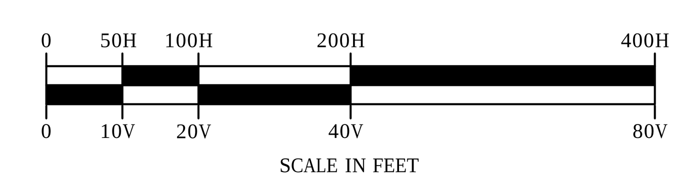
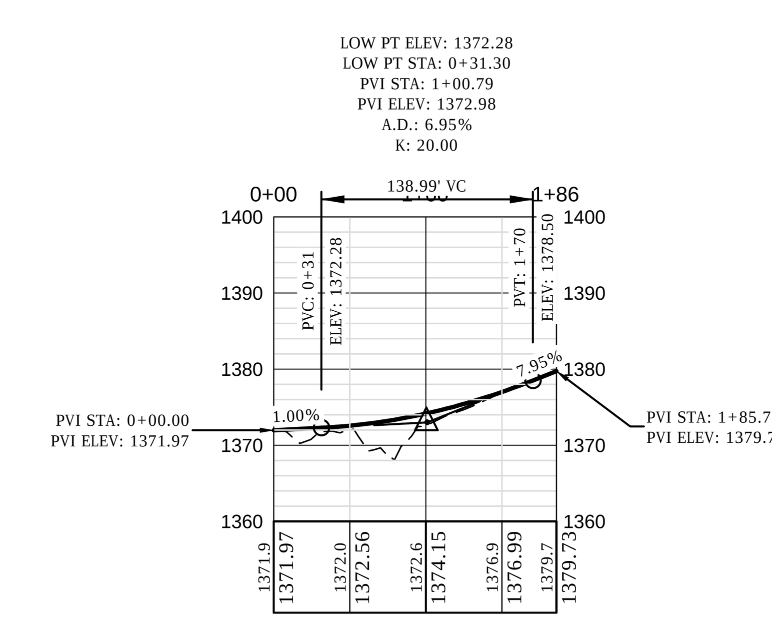
(SEE PLAN SHEET: C 3.3)





TEMPORARY CONTRACTOR ACCESS (CAC)
STA: 0+00 to STA: 1+86
(0+00 AT CENTRAL ACCESS SOUTH)

(SEE PLAN SHEET: C 3.2)

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 12200
ENGIN'D BY: JCD
DRAWN BY: JCD
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ARCHIVE #: H-5107

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL ACCESS SOUTH
TEMPORARY CONTRACTOR ACCESS

SHEET NUMBER: P 3.1

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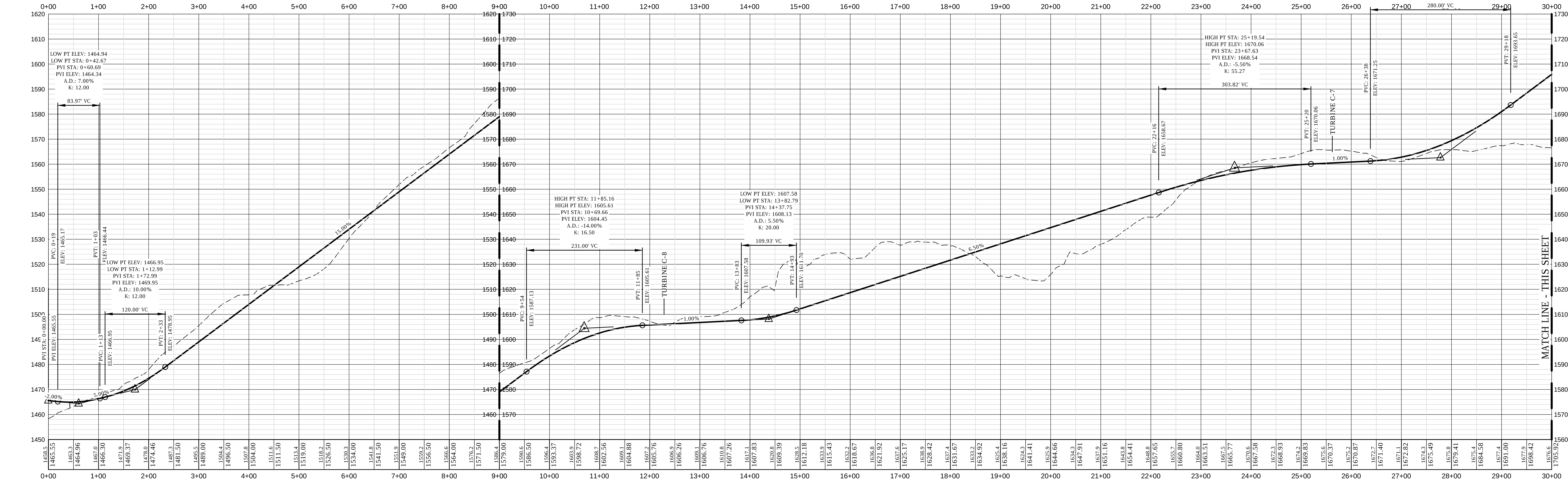


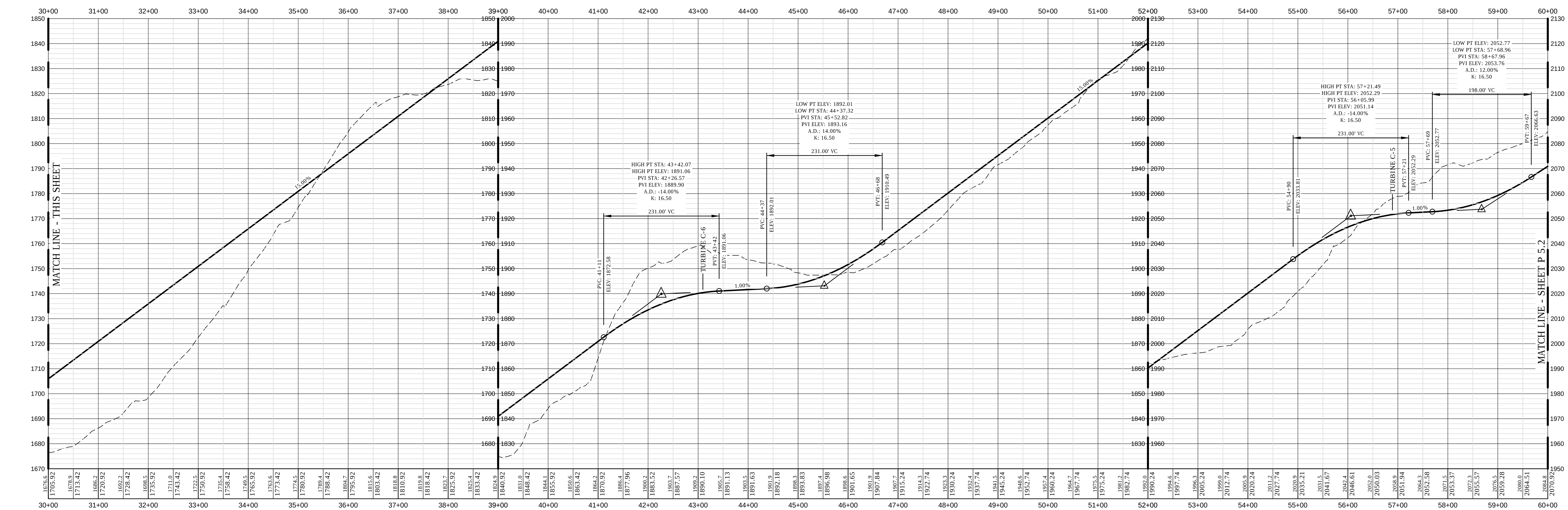
CENTRAL CRANE SOUTH (CCS)

STA: 0+00 to STA: 30+00

0 50H 100H 200H 400H

0 10V 20V 40V 80V

SCALE IN FEET



CENTRAL CRANE SOUTH (CCS)

STA: 30+00 to STA: 60+00

(SEE PLAN SHEETS: C 3.2, C 5.1, C5.2 & C 5.3)

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P:\13185 IRF12\DWGS\70 Percent\corpC-70.dwg, CCS P5-1, 11/21/2013 7:01:40 AM, KRPhilbrick

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 12200
ENGIN'D BY: JCD
DRAWN BY: JCD
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No. 13528
PROFESSIONAL ENGINEER
11/21/13

horizons Engineering inc
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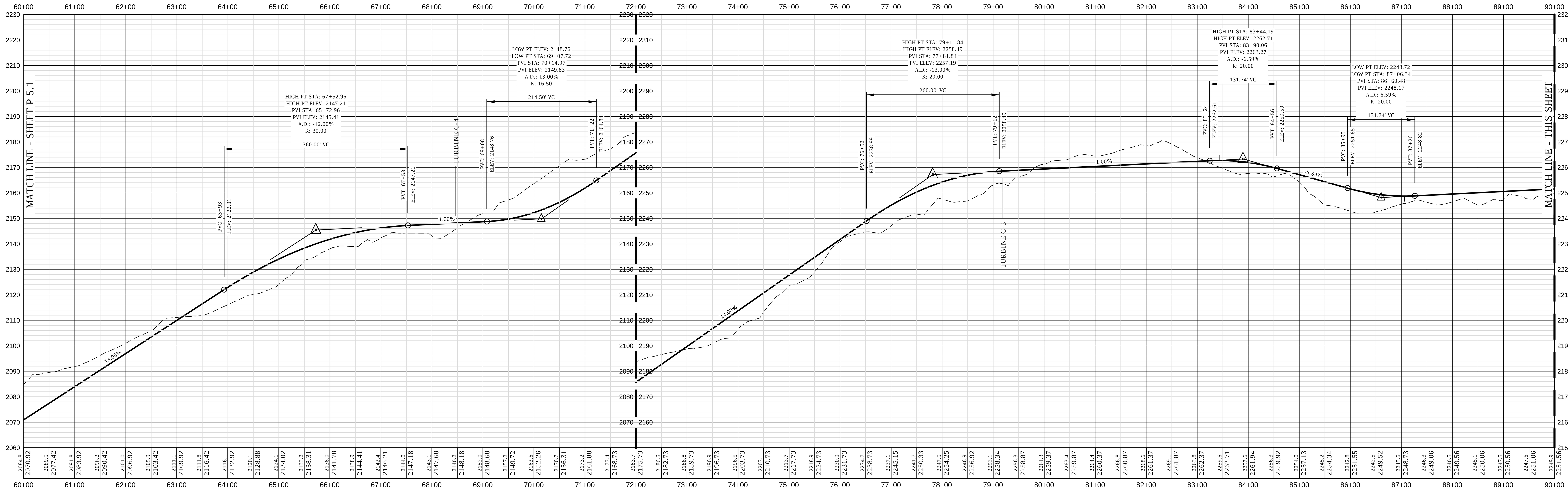
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

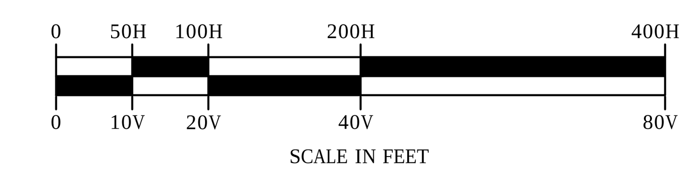
70 PERCENT DESIGN

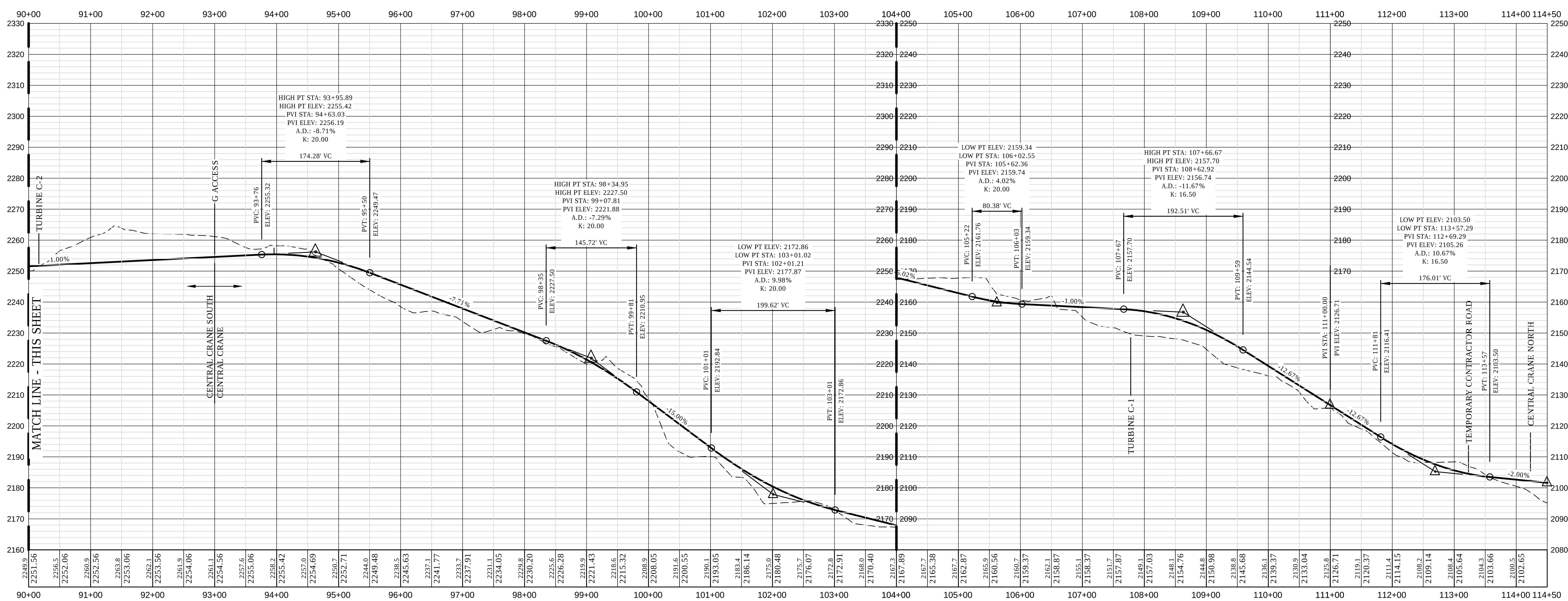
SHEET TITLE: CENTRAL CRANE SOUTH

SHEET NUMBER: P 5.1



CENTRAL CRANE SOUTH (CCS)
STA: 60+00 to STA: 90+00





CENTRAL CRANE SOUTH & CENTRAL CRANE (CCS)
STA: 90+00 to STA: 111+00

(SEE PLAN SHEETS: C 5.3, C 5.4, C 5.5 & C 5.6)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	12200
ENGIN'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE
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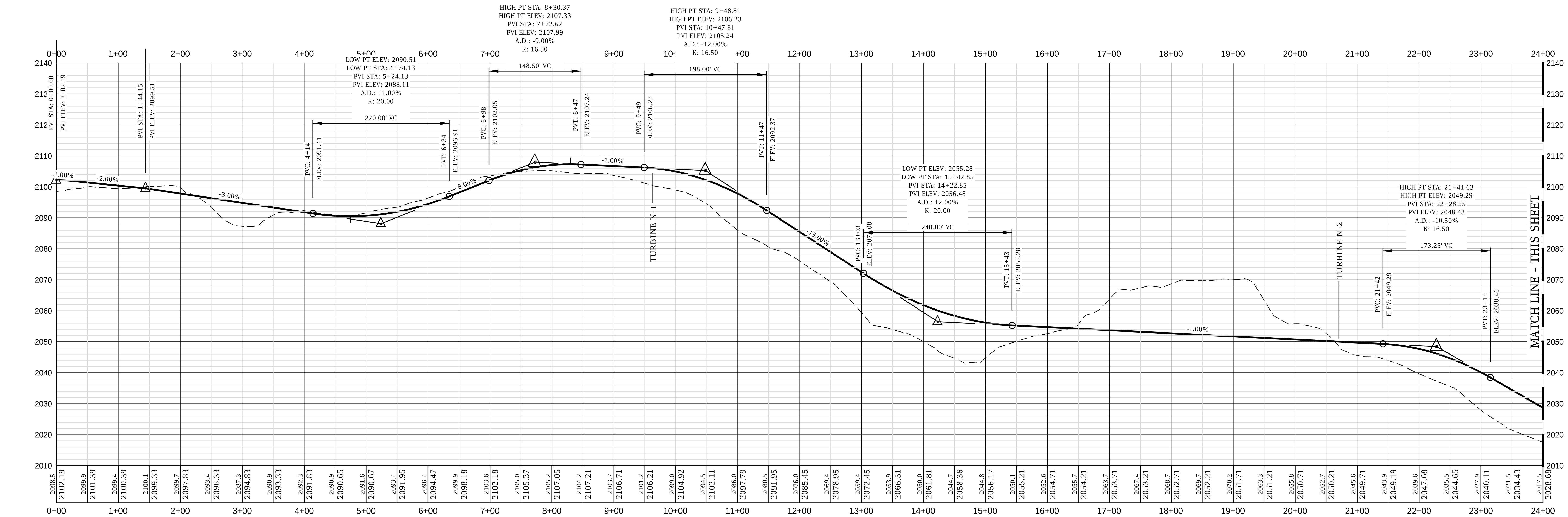
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

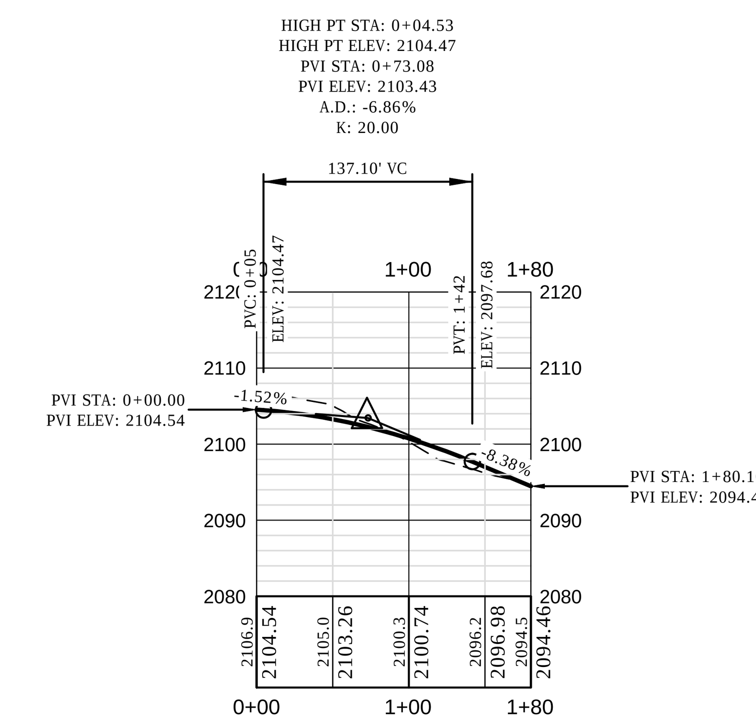
SHEET TITLE: CENTRAL CRANE SOUTH
CENTRAL CRANE

SHEET NUMBER: P 5.2



CENTRAL CRANE NORTH (CCN)

STA: 0+00 to STA: 24+00



TEMP. CONTRACTOR ACCESS (CACN)

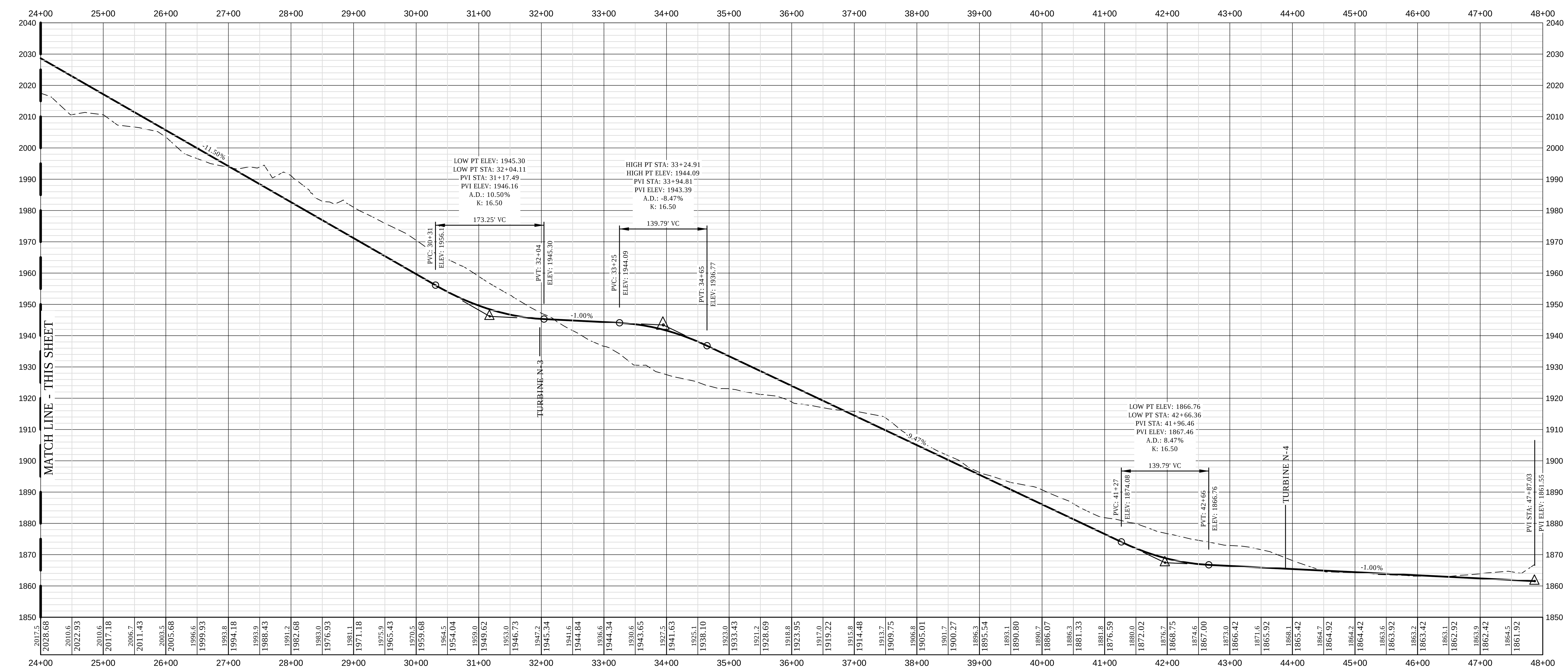
STA: 0+00 to STA: 1+80

(0+00 AT CENTRAL CRANE)

0 50H 100H 200H 400H

0 10V 20V 40V 80V

SCALE IN FEET



CENTRAL CRANE NORTH (CCN)

STA: 24+00 to STA: 48+00

(SEE PLAN SHEETS: C 5.6, C 6.1, C 6.2 & C 6.3)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	12200
ENGIN'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 15328 LICENSED PROFESSIONAL ENGINEER 11/21/13

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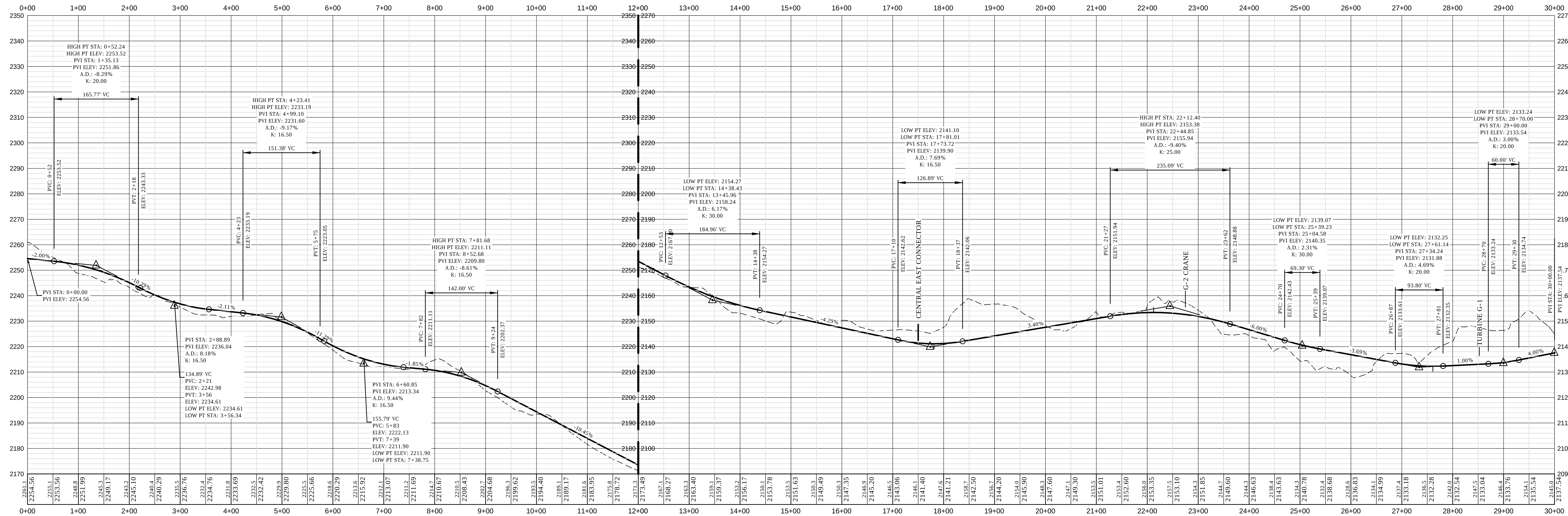
WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

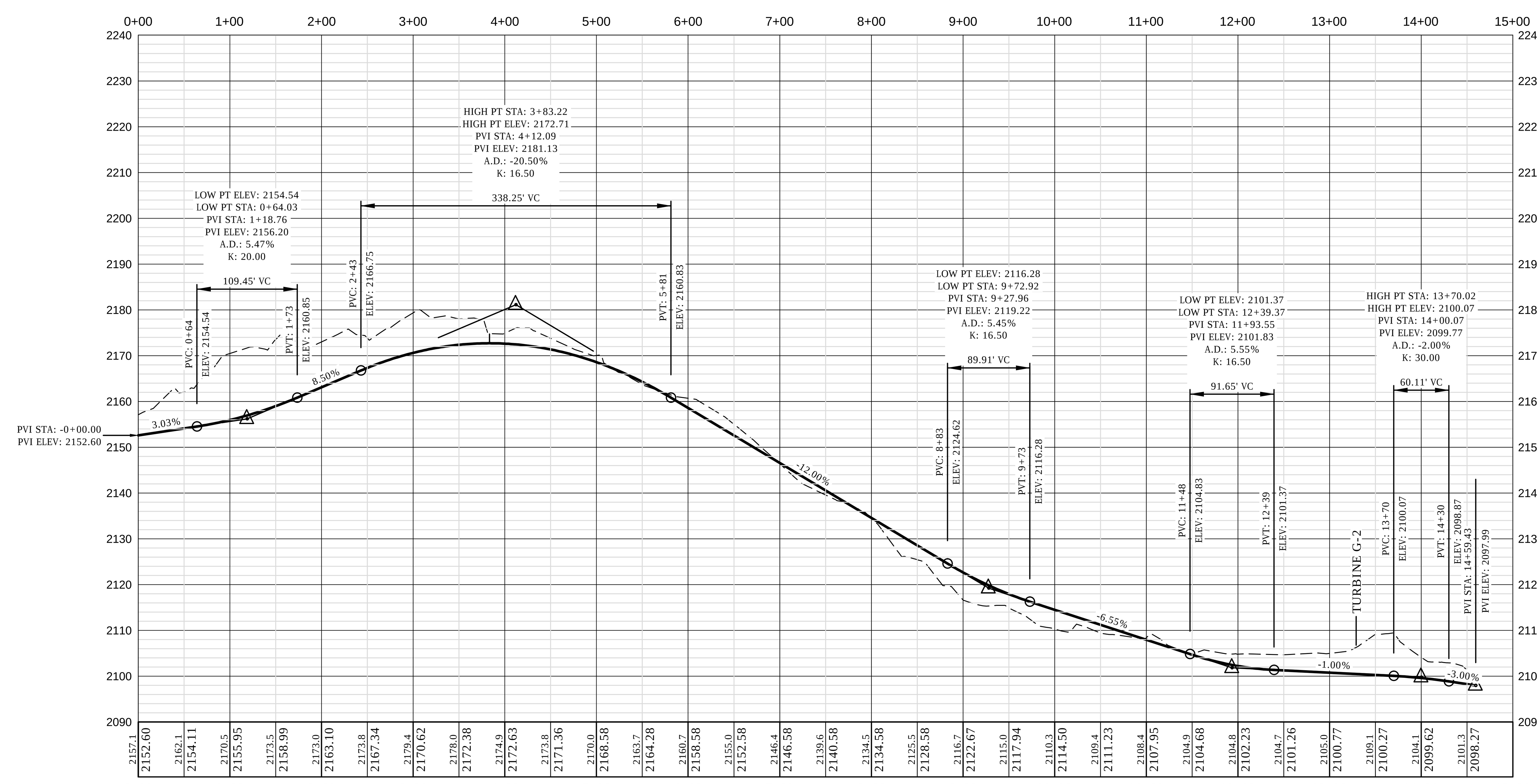
SHEET TITLE: CENTRAL CRANE NORTH TEMPORARY CONTRACTOR ACCESS

SHEET NUMBER: P 6.1



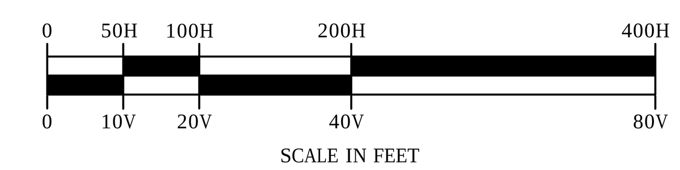
G CRANE (GCA)

STA: 0+00 to STA: 30+00



G-2 CRANE (G2CA)

STA: 0+00 to STA: 15+00



(SEE PLAN SHEET: C 5.5, C 7.1, C 7.2 & C 7.3)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: JCD
DRAWN BY: JCD
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE
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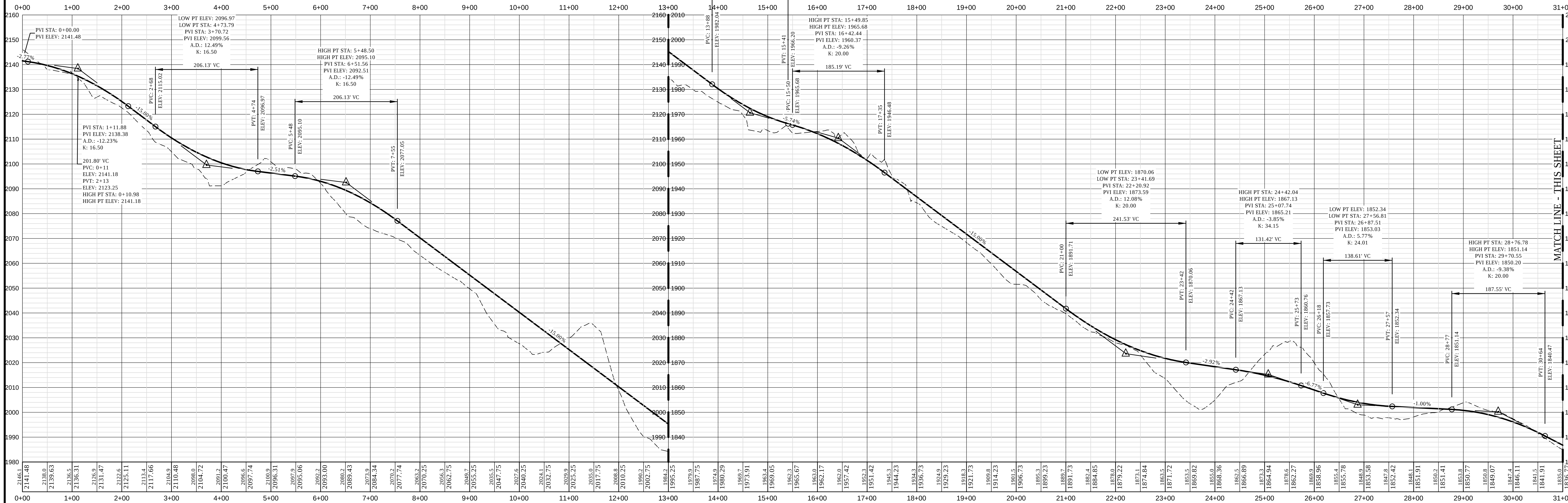
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

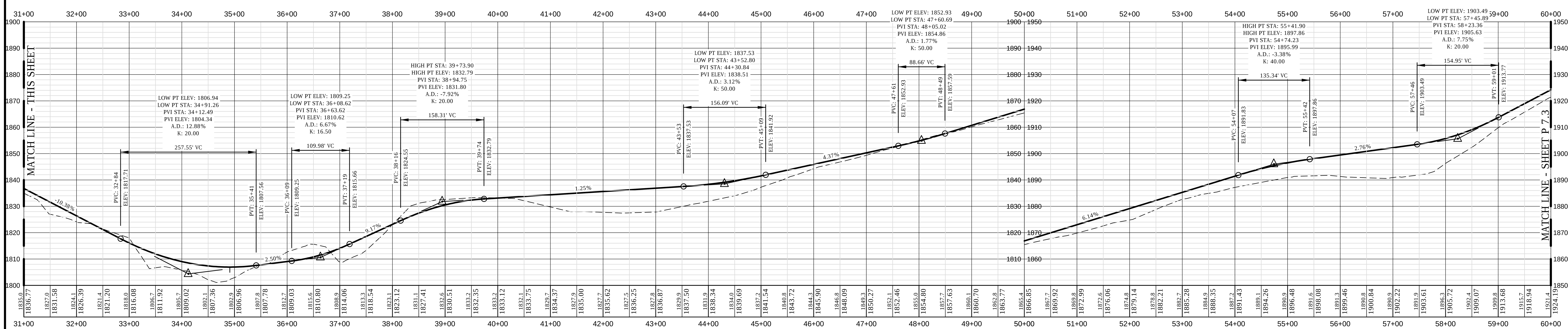
SHEET TITLE: G CRANE
G-2 CRANE

SHEET NUMBER: P 7.1

P:\13185 IRF12\DWGS\70 Percent\corpEG-70.dwg, cec P7-2, 11/21/2013 7:35:33 AM, KRPhilbrick



CENTRAL EAST CONNECTOR (CEC)
STA: 0+00 to STA: 31+00



CENTRAL EAST CONNECTOR (CEC)
STA: 31+00 to STA: 60+00

0 50H 100H 200H 400H
0 10V 20V 40V 80V
SCALE IN FEET

(SEE PLAN SHEET: C 7.2, C 7.4, C 7.5 & C 7.6)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENG'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
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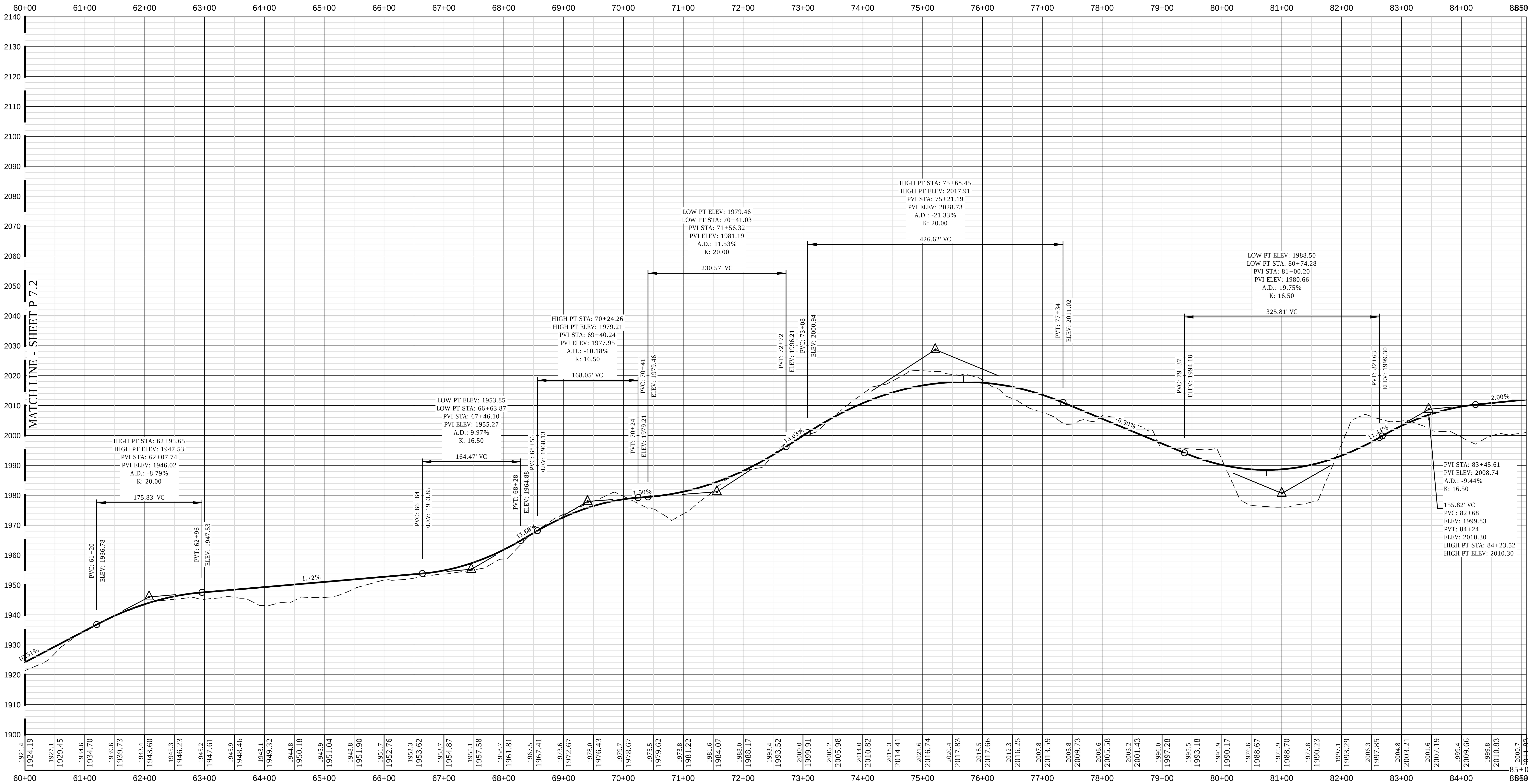
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: CENTRAL EAST CONNECTOR

SHEET NUMBER: P 7.2

MATCH LINE - SHEET P 7.2



CENTRAL EAST CONNECTOR (CEC)
STA: 60+00 to STA: 85+09

0 50H 100H 200H 400H
0 10V 20V 40V 80V
SCALE IN FEET

(SEE PLAN SHEET: P 7.6 & 7.7)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: JCD
DRAWN BY: JCD
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13928 PROFESSIONAL ENGINEER 11/21/13

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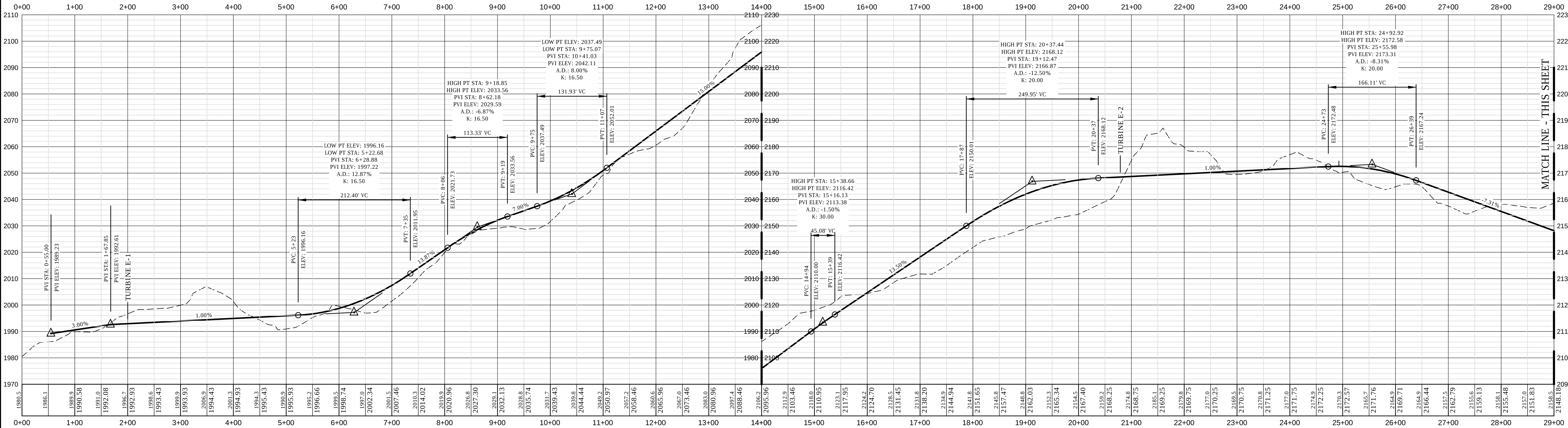
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

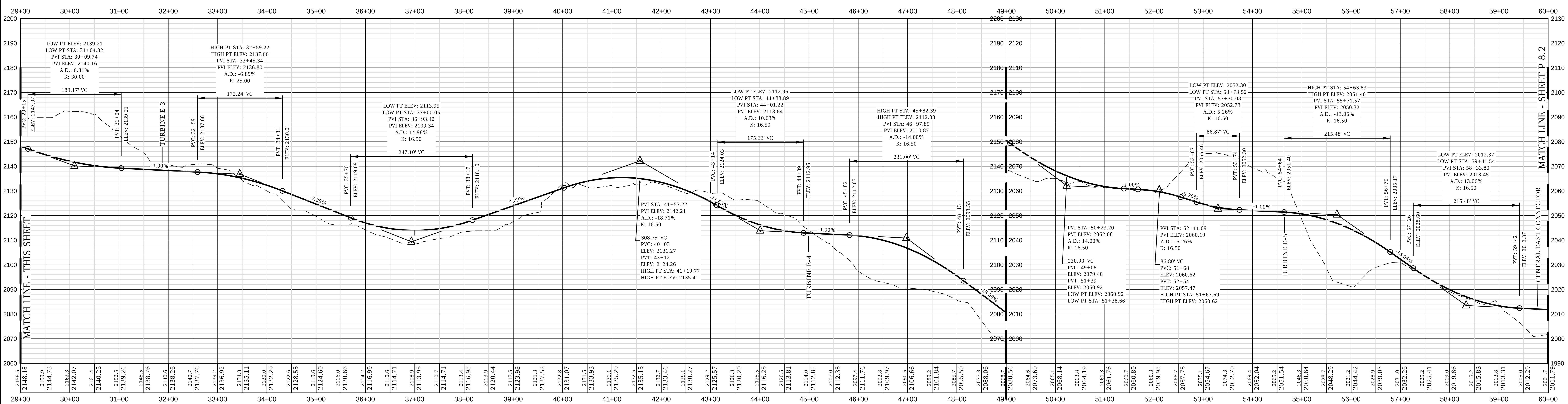
70 PERCENT DESIGN

SHEET TITLE: CENTRAL EAST CONNECTOR

SHEET NUMBER: P 7.3



EAST CRANE SOUTH (ECA)
STA: 0+00 to STA: 29+00



EAST CRANE SOUTH (ECA)
STA: 29+00 to STA: 60+00

0 50H 100H 200H 400H
0 10V 20V 40V 80V
SCALE IN FEET

(SEE PLAN SHEET: C 8.1, C 8.2 & C 7.7)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 PROFESSIONAL ENGINEER 11/21/13

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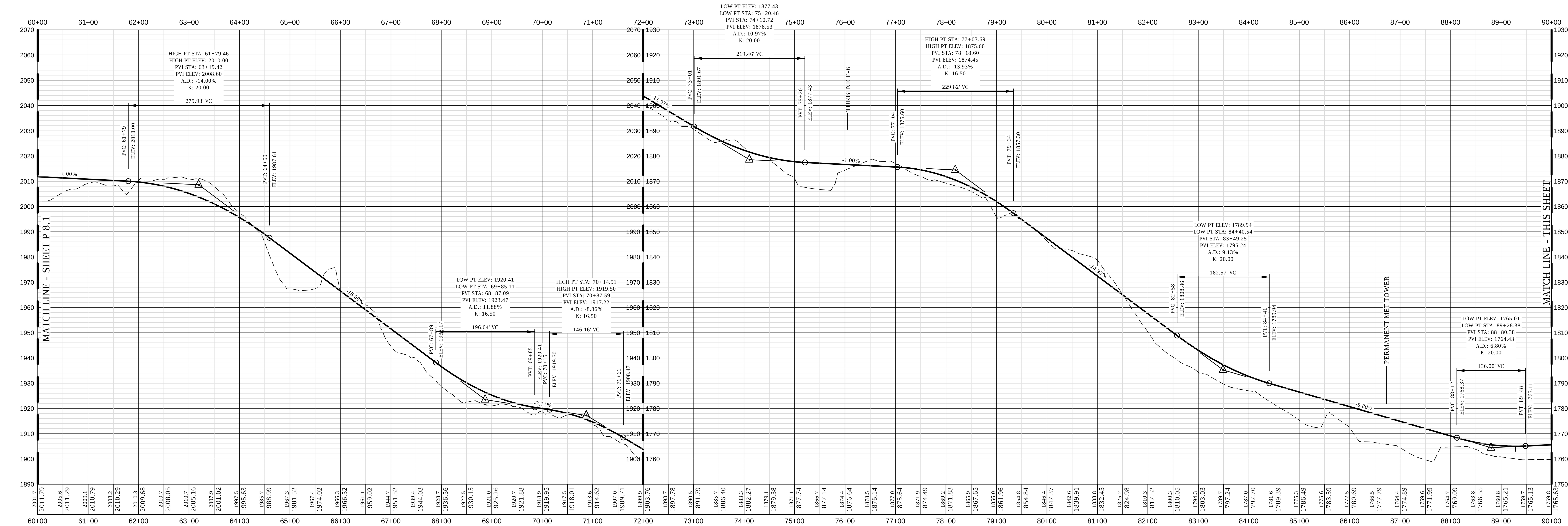
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

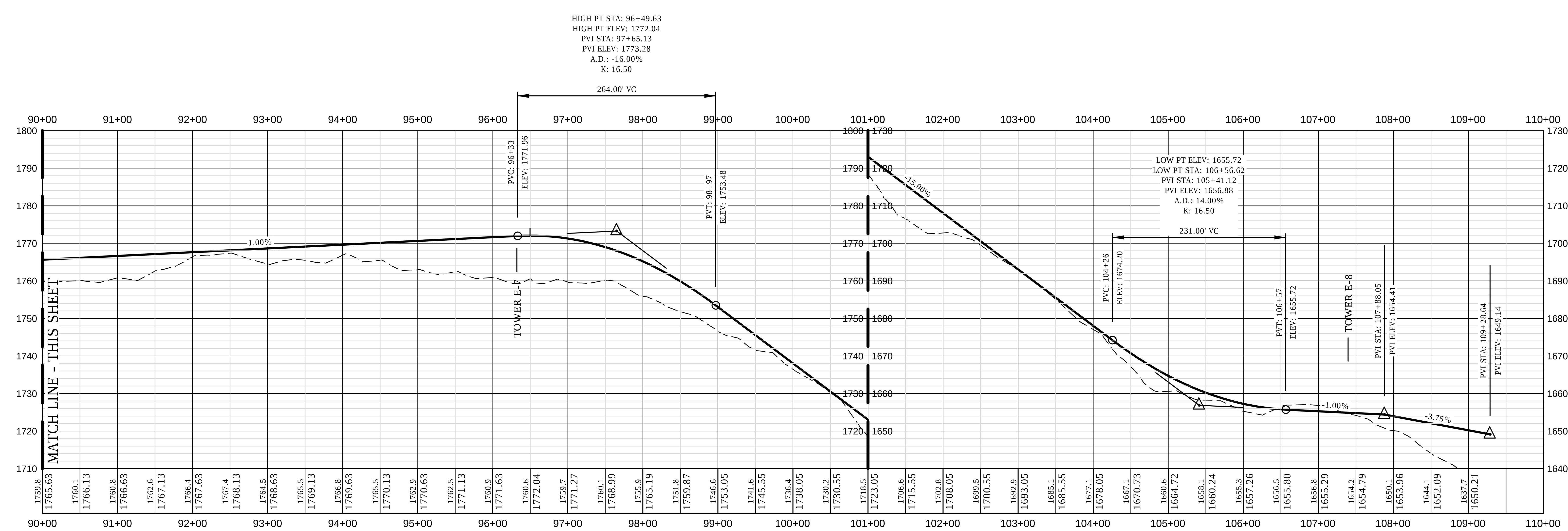
70 PERCENT DESIGN

SHEET TITLE: EAST CRANE SOUTH

SHEET NUMBER: P 8.1



EAST CRANE NORTH (ECA)
STA: 60+00 to STA: 90+00



EAST CRANE NORTH (ECA)
STA: 90+00 to STA: 110+00

0 50H 100H 200H 400H
0 10V 20V 40V 80V
SCALE IN FEET

(SEE PLAN SHEET: C 7.7, C 8.3 & C 8.4)

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENG'D BY: JCD
DRAWN BY: JCD
CHECK'D BY: AJC
ARCHIVE #: H-5107

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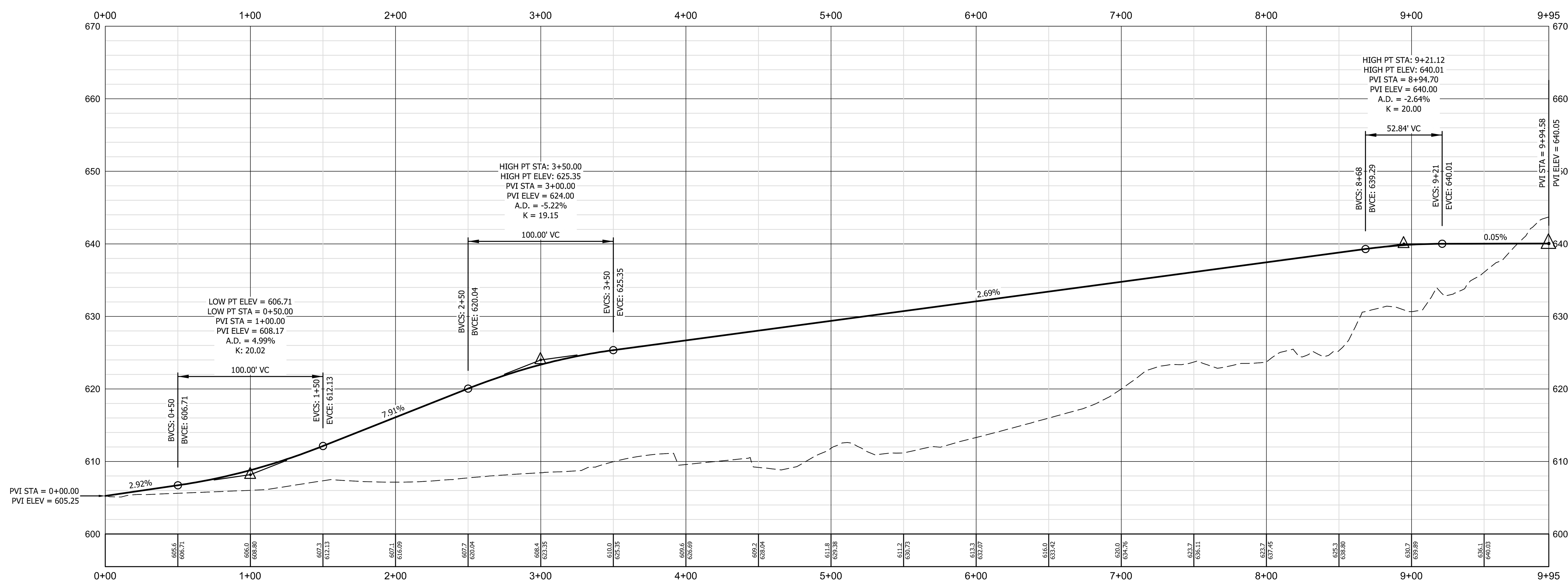
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: EAST CRANE NORTH

SHEET NUMBER: P 8.2



ACCESS ROAD TO SUBSTATION (SubRoad)

STA: 0+00 to STA: 9+95

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: AJC
DRAWN BY:
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 PROFESSIONAL ENGINEER LICENSED
11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: SUBSTATION ACCESS ROAD PROFILE

SHEET NUMBER: P 9.1

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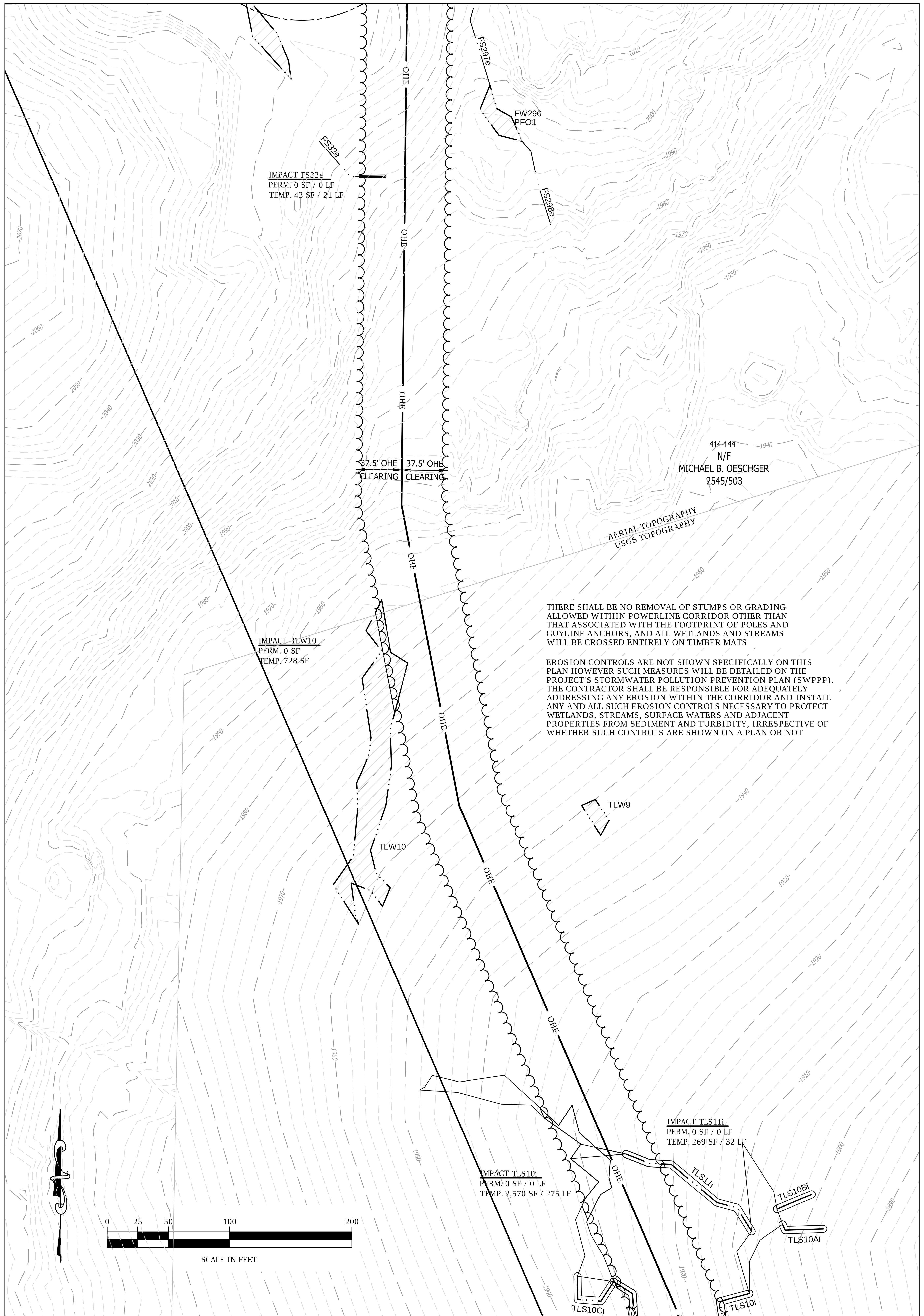
P:\13185 IRF12\DWGS\70 Percent\DES_SubStation\70 drainage.dwg, SUB-PROF P 9-1, 11/22/2013 2:16:52 PM, jdaigneault

MATCH LINE - SHEET C 7.7



MATCH LINE - THIS SHEET

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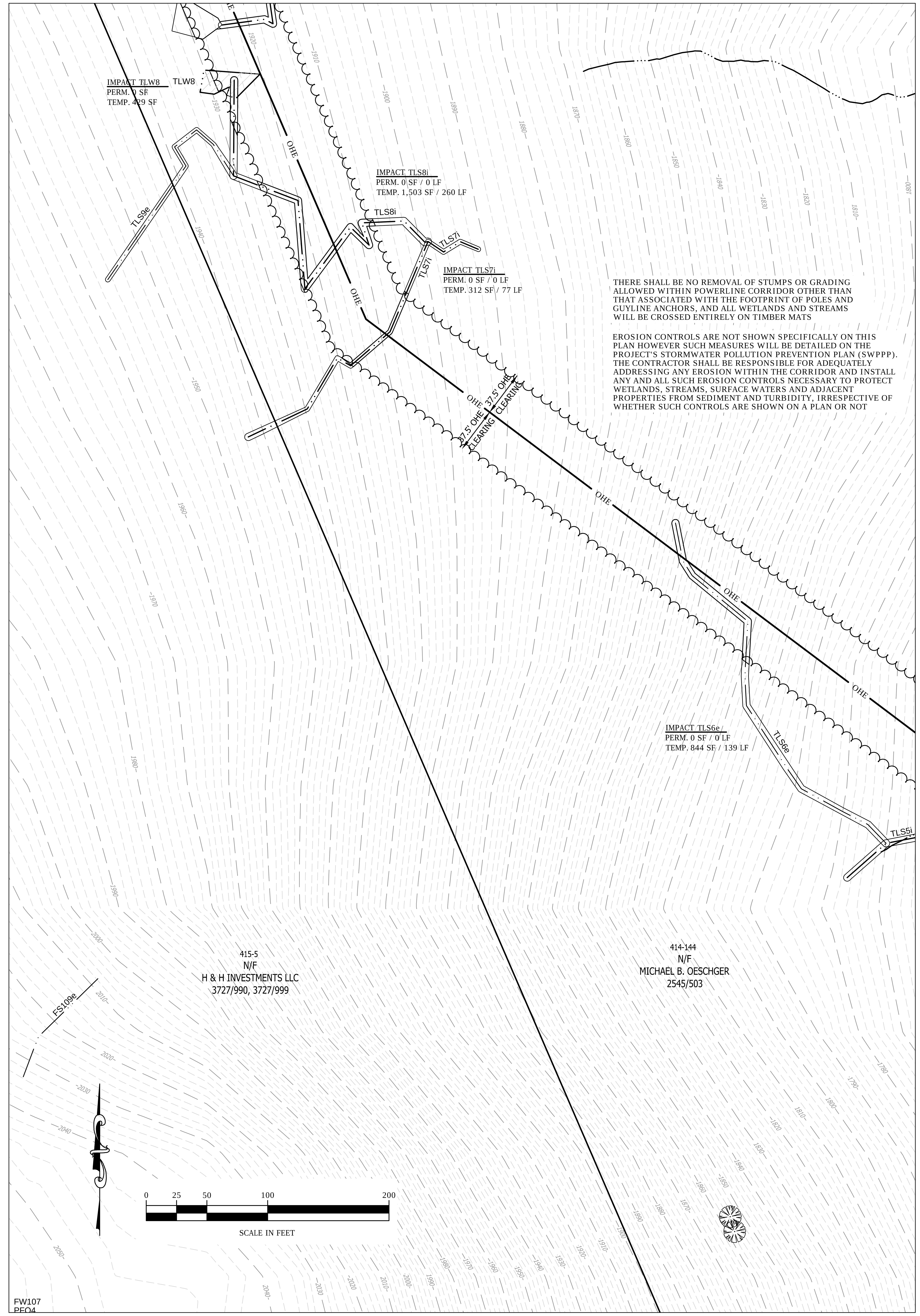
MATCH LINE - THIS SHEET



MATCH LINE - SHEET C 10.2

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	DEB
DRAWN BY:	DEB
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13528 LICENSED PROFESSIONAL ENGINEER
11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

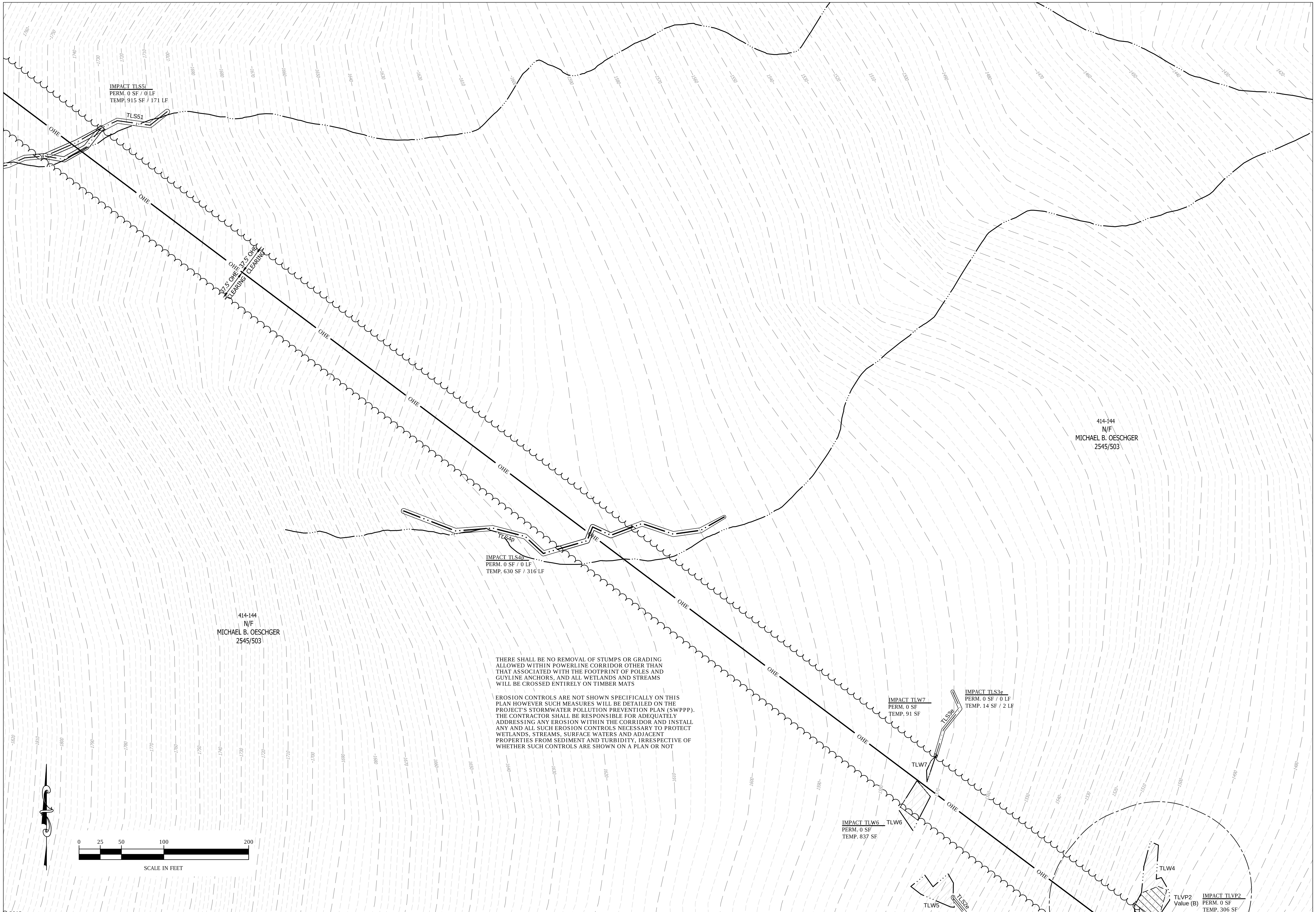
70 PERCENT DESIGN

SHEET TITLE: OVERHEAD ELECTRIC LINE

SHEET NUMBER: C 10.1

P:\13185 IBF12\DWGS\70 Percent\cut\ELEC-70.dwg, TLine C10.1, 11/22/2013 8:42:43 AM, jdaigneault

MATCH LINE - SHEET C 10.1



MATCH LINE - SHEET C 10.3

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
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DRAWN BY:	DEB
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE - ARTHUR JOHN COLVIN No. 13828 - LICENSED PROFESSIONAL ENGINEER
11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

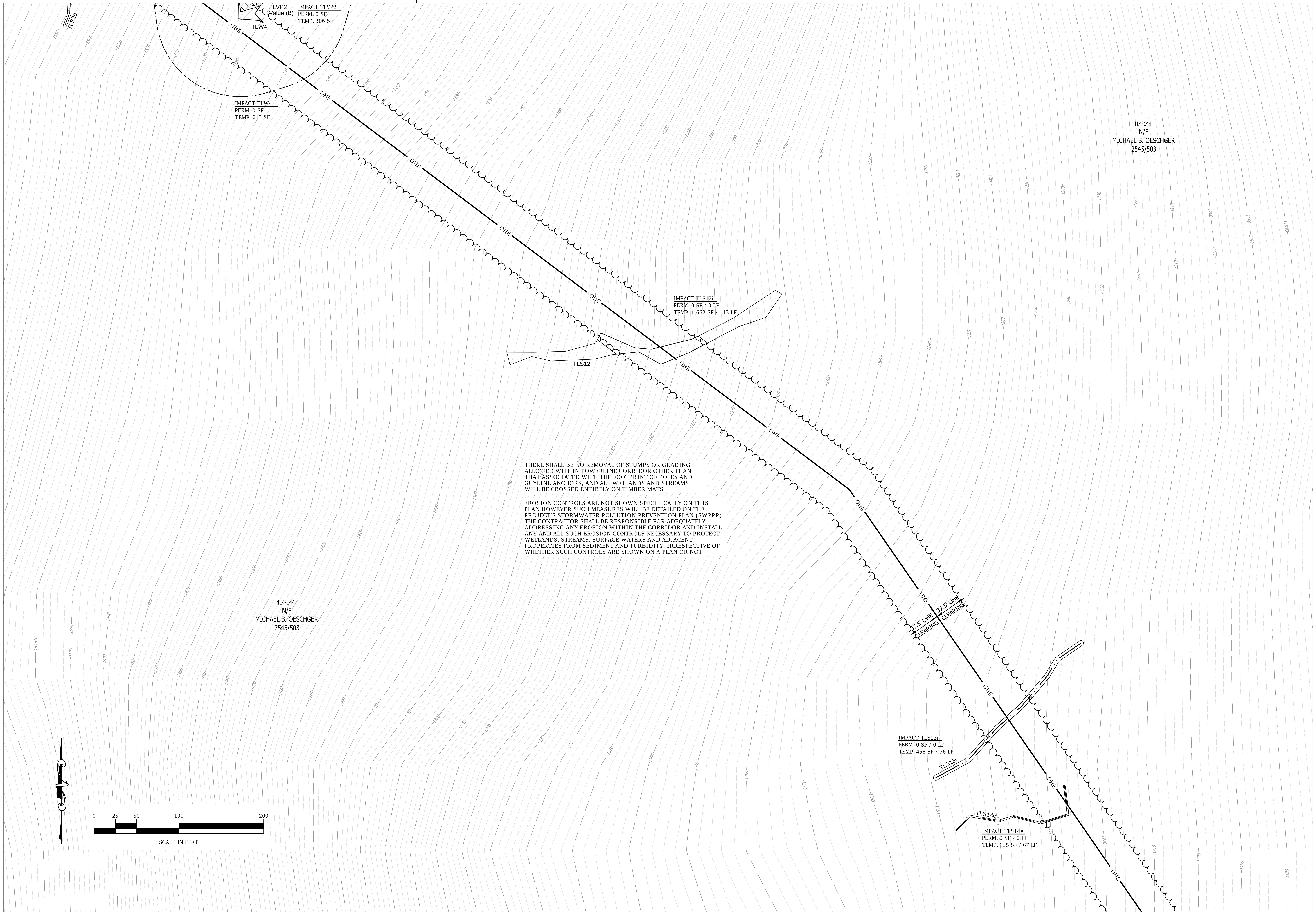
70 PERCENT DESIGN

SHEET TITLE:
OVERHEAD ELECTRIC LINE

SHEET NUMBER: C 10.2

P:\13185 IRF12\DWGS\70 Percent\cut\ELEC-70.dwg, TLine C10.2, 11/22/2013 8:43:16 AM, jdaigneault

MATCH LINE - SHEET C 10.2



THERE SHALL BE NO REMOVAL OF STUMPS OR GRADING ALLOWED WITHIN POWERLINE CORRIDOR OTHER THAN THAT ASSOCIATED WITH THE FOOTPRINT OF POLES AND GUYLINE ANCHORS, AND ALL WETLANDS AND STREAMS WILL BE CROSSED ENTIRELY ON TIMBER MATS

EROSION CONTROLS ARE NOT SHOWN SPECIFICALLY ON THIS PLAN HOWEVER SUCH MEASURES WILL BE DETAILED ON THE PROJECT'S STORMWATER POLLUTION PREVENTION PLAN (SWPPP). THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATELY ADDRESSING ANY EROSION WITHIN THE CORRIDOR AND INSTALL ANY AND ALL SUCH EROSION CONTROLS NECESSARY TO PROTECT WETLANDS, STREAMS, SURFACE WATERS AND ADJACENT PROPERTIES FROM SEDIMENT AND TURBIDITY, IRRESPECTIVE OF WHETHER SUCH CONTROLS ARE SHOWN ON A PLAN OR NOT

MATCH LINE - SHEET C 10.4

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: DEB
DRAWN BY: DEB
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13528 LICENSED PROFESSIONAL ENGINEER 11/21/13

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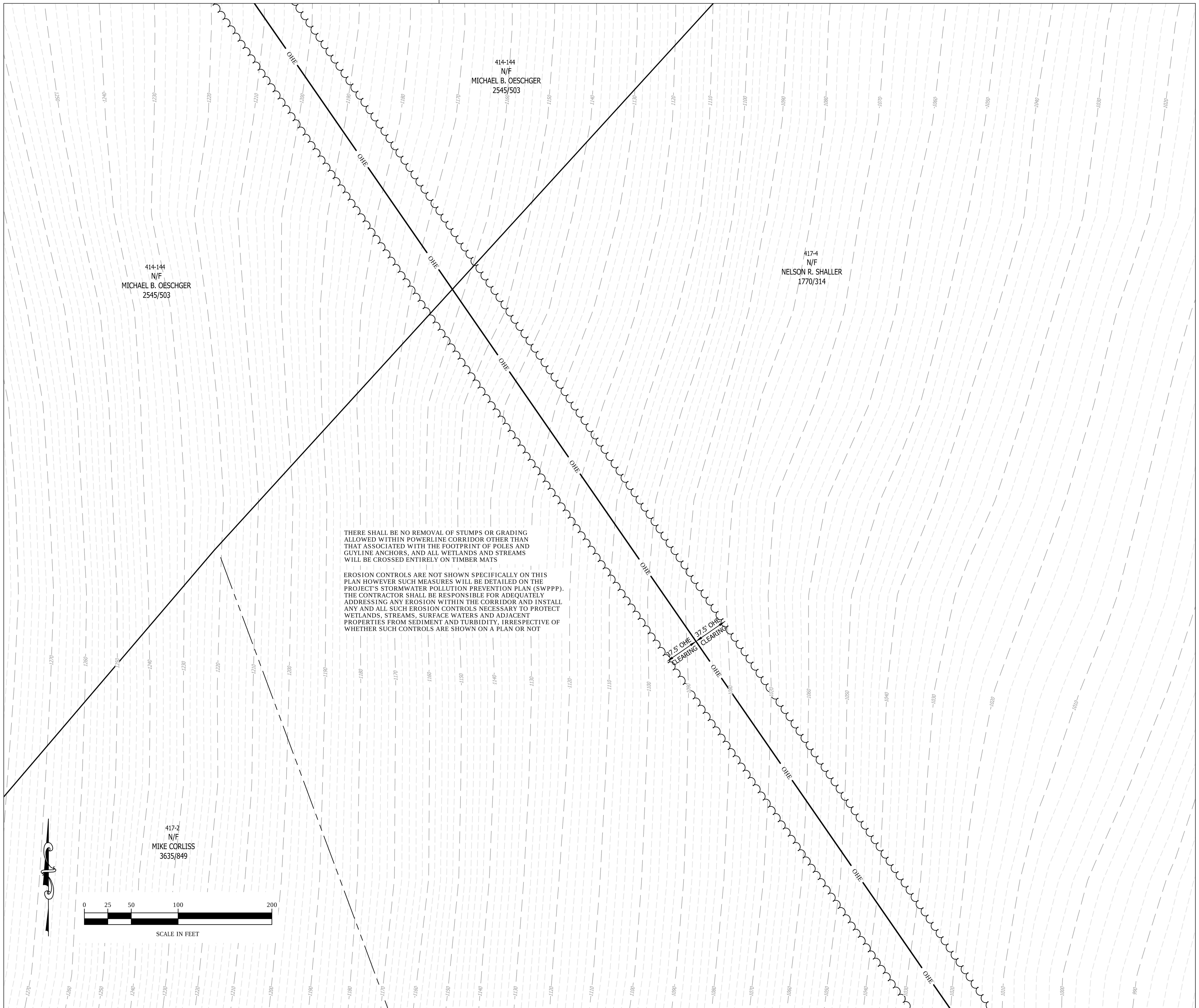
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH
70 PERCENT DESIGN

SHEET TITLE: OVERHEAD ELECTRIC LINE

SHEET NUMBER: C 10.3

P:\13185 IBF12\DWGS\70 Percent\cut\ELEC-70.dwg, TLine C10.3, 11/22/2013 8:43:41 AM, jdaigneault

MATCH LINE - SHEET C 10.3



THERE SHALL BE NO REMOVAL OF STUMPS OR GRADING ALLOWED WITHIN POWERLINE CORRIDOR OTHER THAN THAT ASSOCIATED WITH THE FOOTPRINT OF POLES AND GUYLINE ANCHORS, AND ALL WETLANDS AND STREAMS WILL BE CROSSED ENTIRELY ON TIMBER MATS

EROSION CONTROLS ARE NOT SHOWN SPECIFICALLY ON THIS PLAN HOWEVER SUCH MEASURES WILL BE DETAILED ON THE PROJECT'S STORMWATER POLLUTION PREVENTION PLAN (SWPPP). THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATELY ADDRESSING ANY EROSION WITHIN THE CORRIDOR AND INSTALL ANY AND ALL SUCH EROSION CONTROLS NECESSARY TO PROTECT WETLANDS, STREAMS, SURFACE WATERS AND ADJACENT PROPERTIES FROM SEDIMENT AND TURBIDITY, IRRESPECTIVE OF WHETHER SUCH CONTROLS ARE SHOWN ON A PLAN OR NOT

MATCH LINE - SHEET C 10.5

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: DEB
DRAWN BY: DEB
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 PROFESSIONAL ENGINEER 11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: OVERHEAD ELECTRIC LINE

SHEET NUMBER: C 10.4

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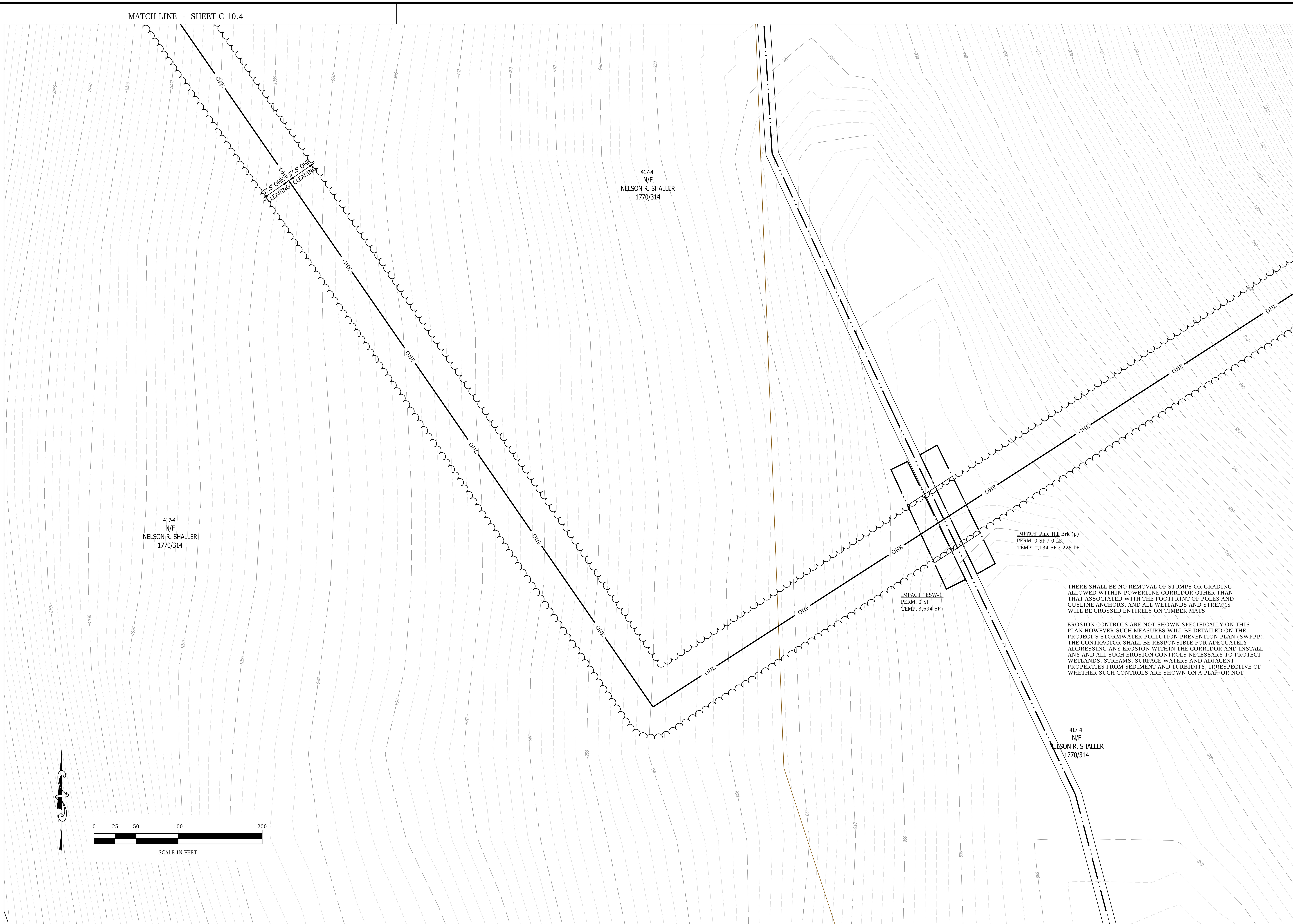
P:\13185 IRF12\DWGS\70 Percent\cutELEC-70.dwg, TLine C10.4, 11/22/2013 8:44:06 AM, jdaigneault



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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	DEB
DRAWN BY:	DEB
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE - ARTHUR JOHN COLVIN No. 13828 LICENSED PROFESSIONAL ENGINEER
11/21/13

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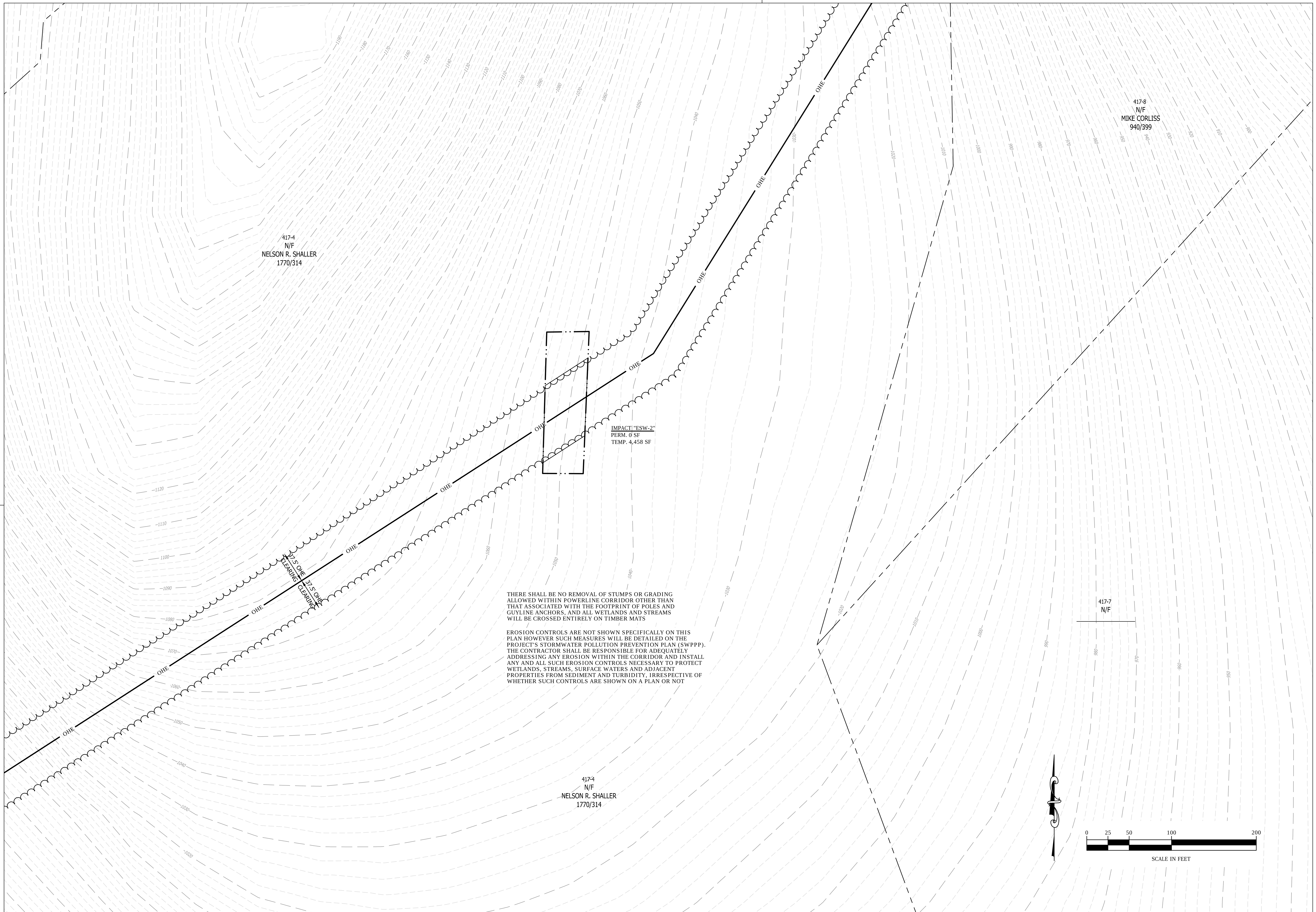
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH
70 PERCENT DESIGN

SHEET TITLE: OVERHEAD ELECTRIC LINE

SHEET NUMBER: C 10.5

P:\13185 IRF12\DWGS\70 Percent\cut\ELEC-70.dwg, TLine C10.5, 11/22/2013 8:44:31 AM, jdaigneault

MATCH LINE - SHEET C 10.7



THERE SHALL BE NO REMOVAL OF STUMPS OR GRADING ALLOWED WITHIN POWERLINE CORRIDOR OTHER THAN THAT ASSOCIATED WITH THE FOOTPRINT OF POLES AND GUYLINE ANCHORS, AND ALL WETLANDS AND STREAMS WILL BE CROSSED ENTIRELY ON TIMBER MATS

EROSION CONTROLS ARE NOT SHOWN SPECIFICALLY ON THIS PLAN HOWEVER SUCH MEASURES WILL BE DETAILED ON THE PROJECT'S STORMWATER POLLUTION PREVENTION PLAN (SWPPP). THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATELY ADDRESSING ANY EROSION WITHIN THE CORRIDOR AND INSTALL ANY AND ALL SUCH EROSION CONTROLS NECESSARY TO PROTECT WETLANDS, STREAMS, SURFACE WATERS AND ADJACENT PROPERTIES FROM SEDIMENT AND TURBIDITY, IRRESPECTIVE OF WHETHER SUCH CONTROLS ARE SHOWN ON A PLAN OR NOT

MATCH LINE - SHEET C 10.5

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: DEB
DRAWN BY: DEB
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No.13828 LICENSED PROFESSIONAL ENGINEER
11/21/13

horizons Engineering Inc
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: OVERHEAD ELECTRIC LINE

SHEET NUMBER: C 10.6

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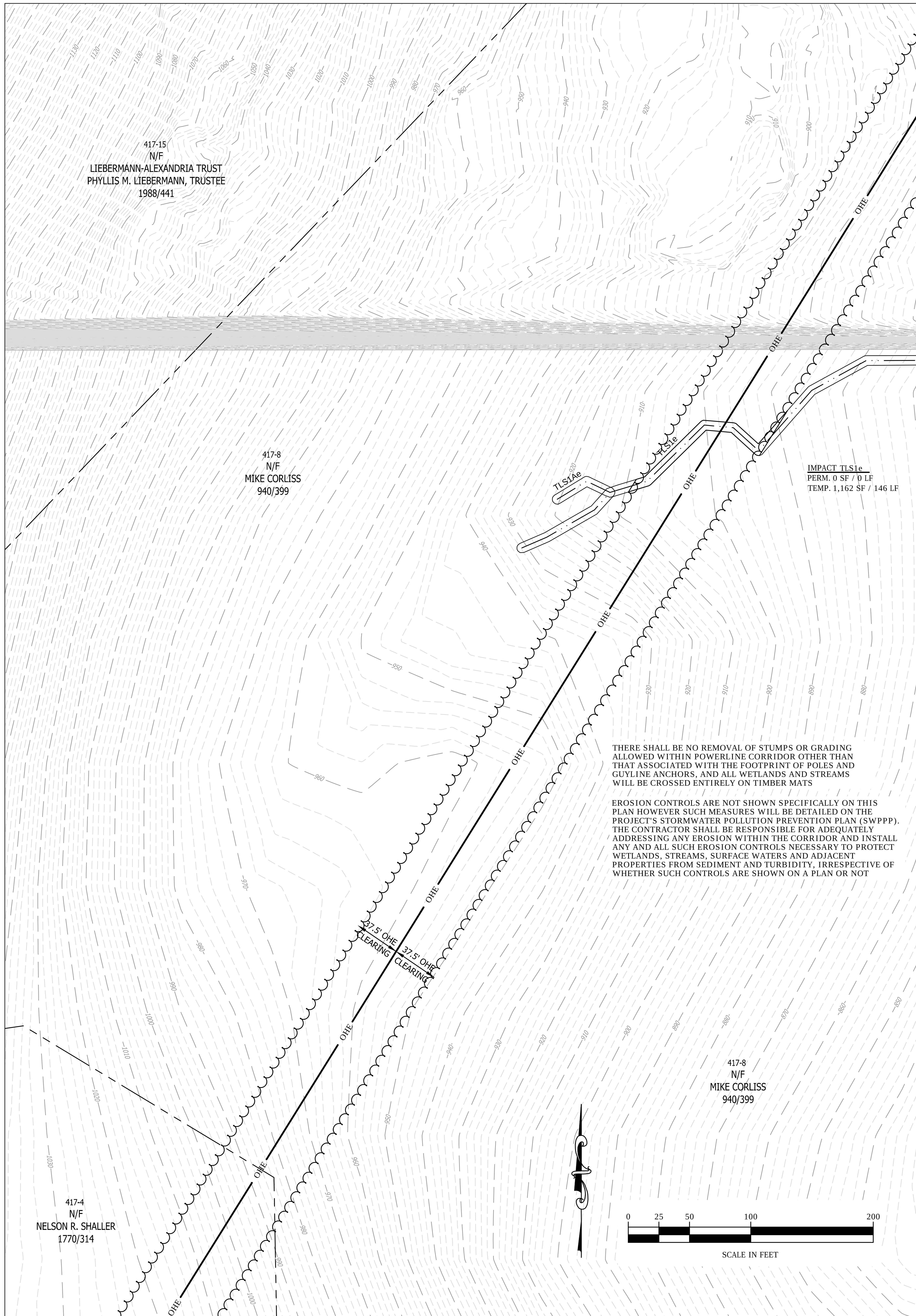

MATCH LINE - THIS SHEET

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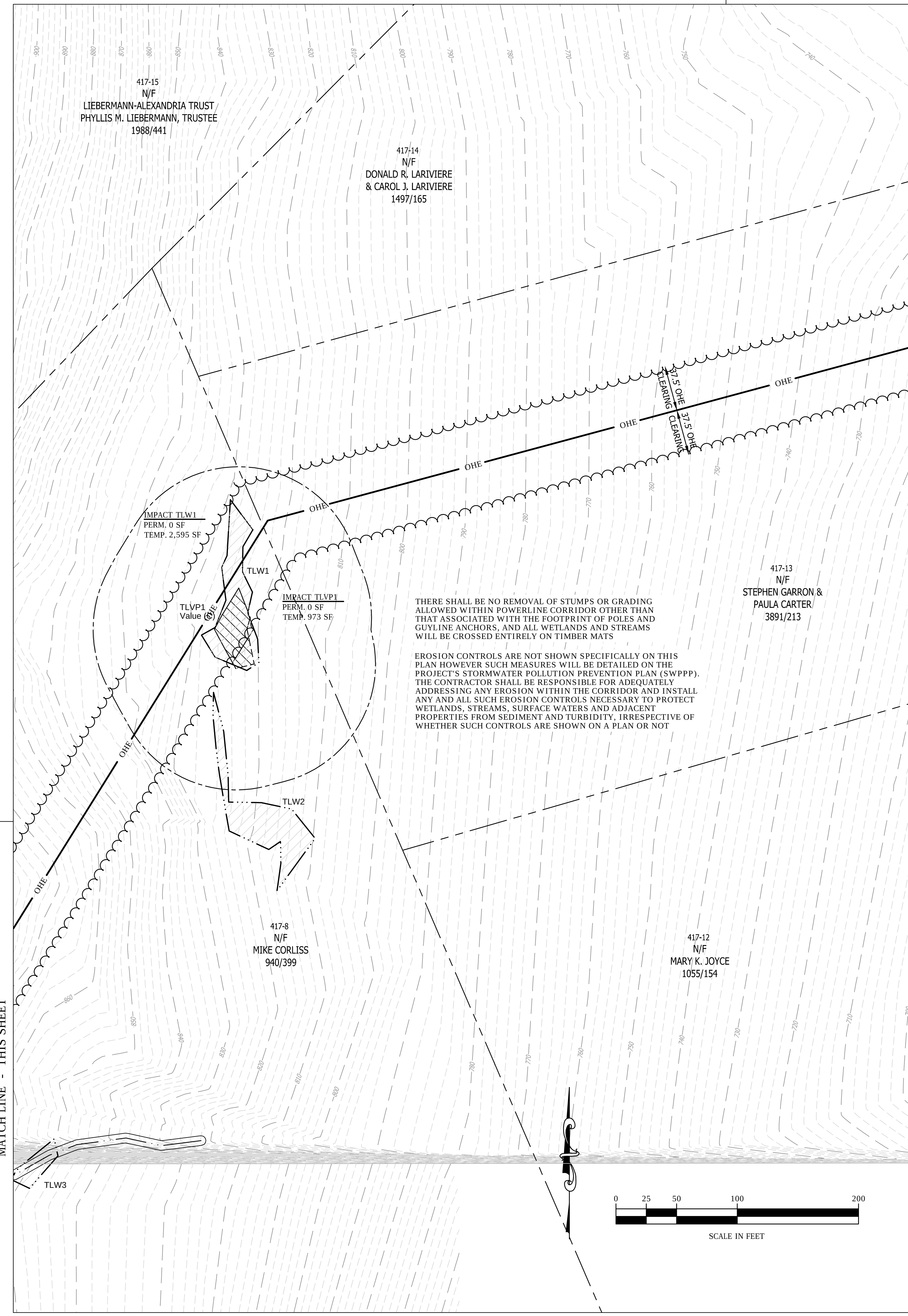
MATCH LINE - SHEET C 10.6

MATCH LINE - SHEET C 9.1



MATCH LINE - THIS SHEET

MATCH LINE - SHEET C 9.1

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
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STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13528 LICENSED PROFESSIONAL ENGINEER 11/21/13

horizons Engineering inc
34 School Street
Littleton, NH 03561
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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: OVERHEAD ELECTRIC LINE

SHEET NUMBER: C 10.7

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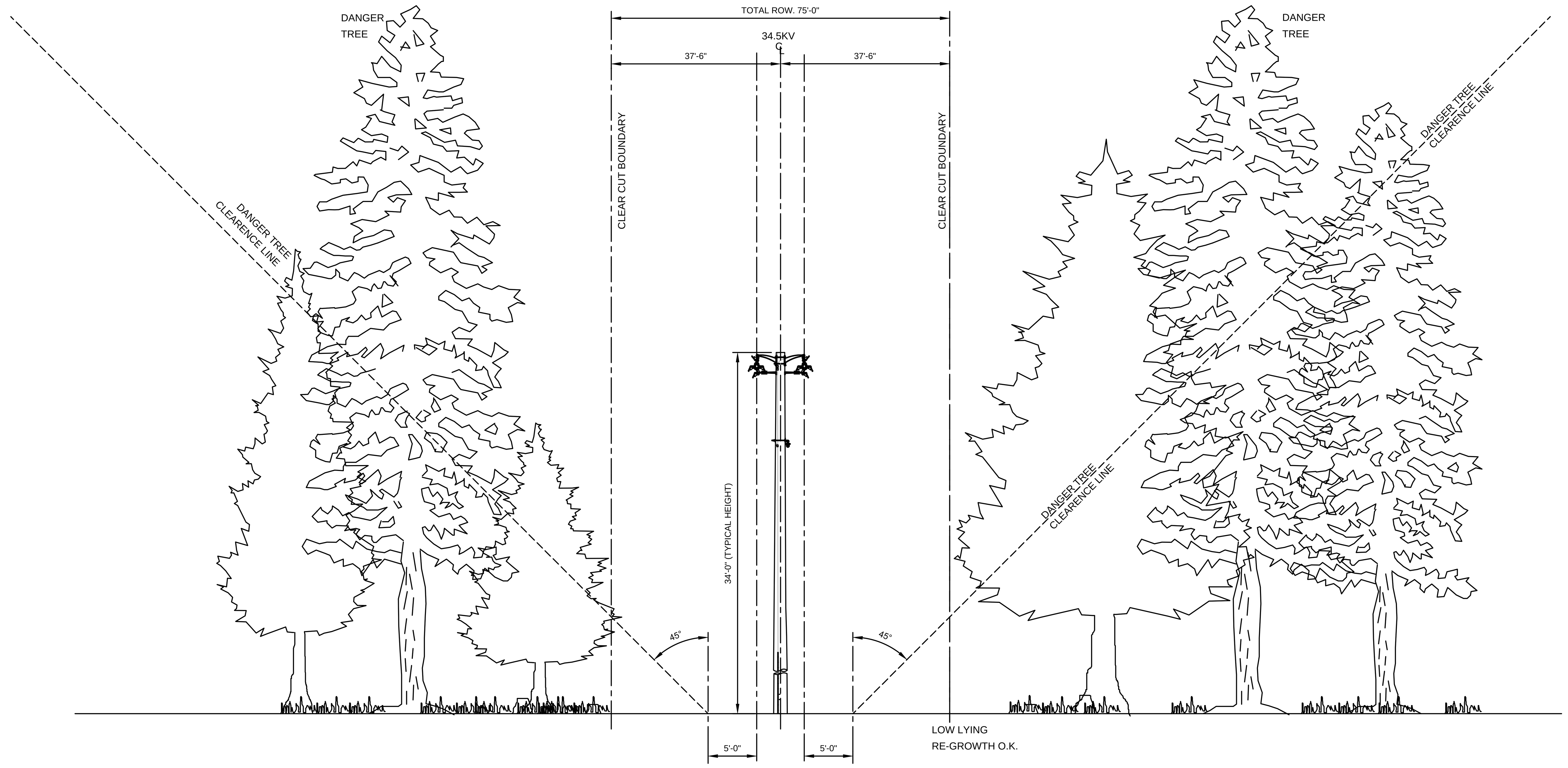

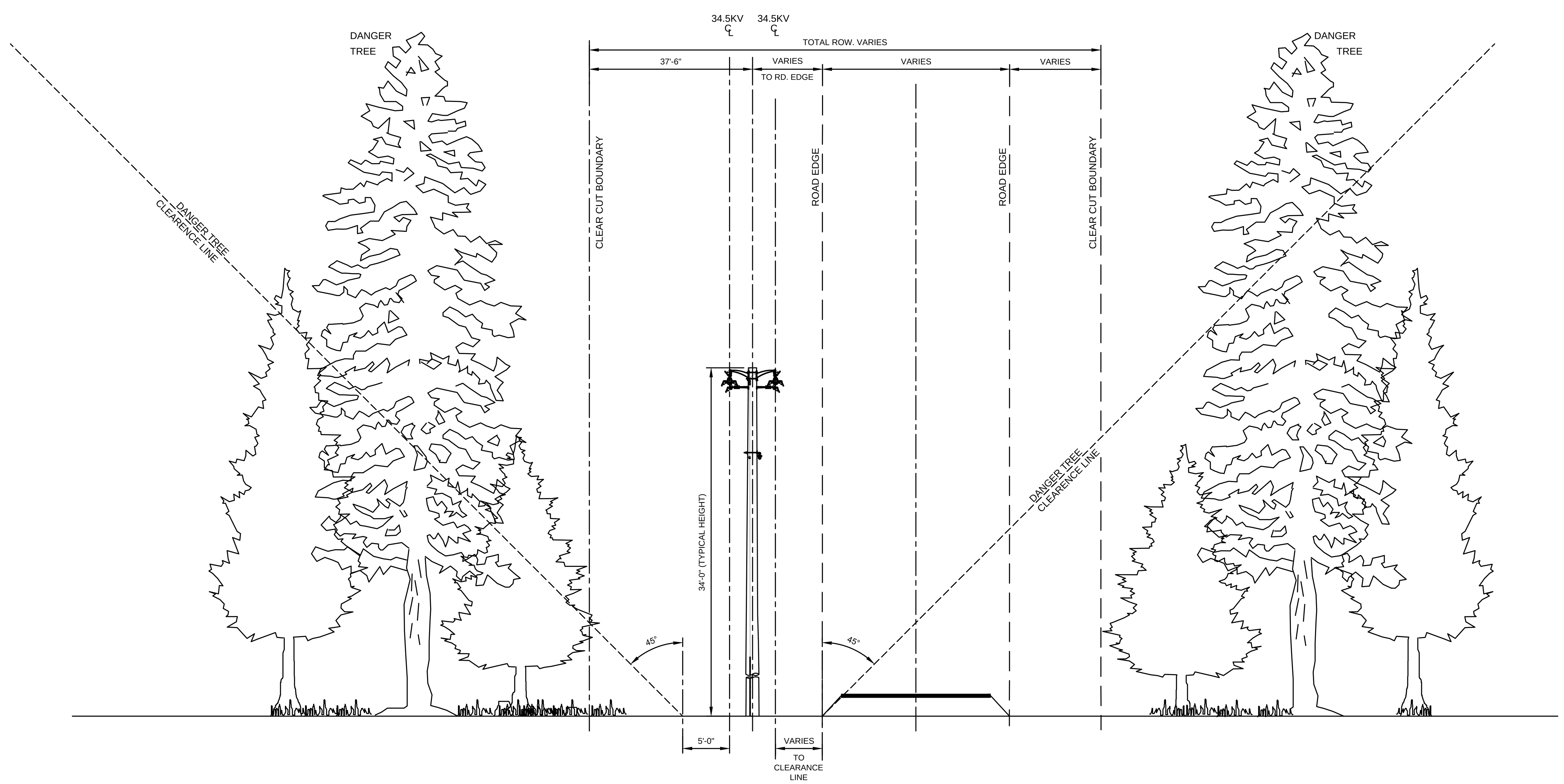

NOTE:
A DANGER TREE SHALL BE DEFINED AS A TREE THAT EITHER EXTENDS INTO THE RIGHT-OF-WAY (ROW) BUT WHOSE TRUNK IS OUTSIDE THE ROW OR THOSE ARE LIKELY TO FALL INTO THE TRANSMISSION LINE DUE TO DISEASES, EXCESSIVE LEAN, UNSTABLE SOILS, WEAK SPECIES OR OTHER CONDITIONS THAT A QUALIFIED INSPECTOR MAY DEEM THEM AS A DANGER TREE.

STUMPS ARE TO REMAIN IN PLACE WITHIN 75' R.O.W. CLEAR CUT BOUNDARY. A SWATH 10' WIDE CENTERED ON THE R.O.W. SHALL HAVE STUMPS CUT FLUSH TO THE GROUND TO ALLOW ACCESS DOWN THE R.O.W.

WILD MEADOWS WIND PROJECT
IBERDROLA RENEWABLES
ALEXANDRIA & DANBURY, NEW HAMPSHIRE
SCALE: NTS SIZE: ARCH D
34.5KV AERIAL COLLECTION LINE
SKETCH DRAWING ROW REQ'D ALONG W/SPACER CABLE

DATE: 11/01/13
DRAWN BY: NRM
ENGIN'D BY: DPE
PROJECT #: 22036
DRAWING #: E-112 SH.1

IBERDROLA RENEWABLES

RLC ENGINEERING
267 Whitten Road
Hallowell, ME 04347
Phone 207-621-1077
Fax 207-621-1177
www.rlc-eng.com

REV	DESCRIPTION	DATE	DRWN	CHKD	APP'D
A	FOR PERMIT APPLICATION ONLY-NOT FOR CONSTRUCTION	11/01/13	NRM	ARH	DPE

SEAL:

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: RLC
DRAWN BY: RLC
CHECK'D BY: RLC
ARCHIVE #: H-5107

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

horizons Engineering inc
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: ELECTRICAL DETAILS

SHEET NUMBER: E 1.1

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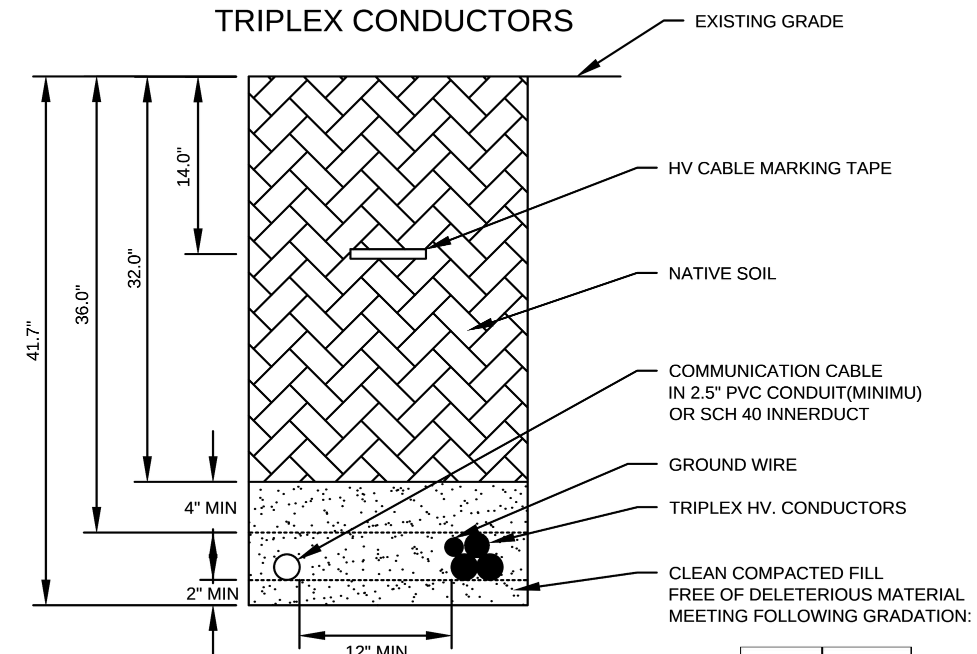
DIRECT BURIAL

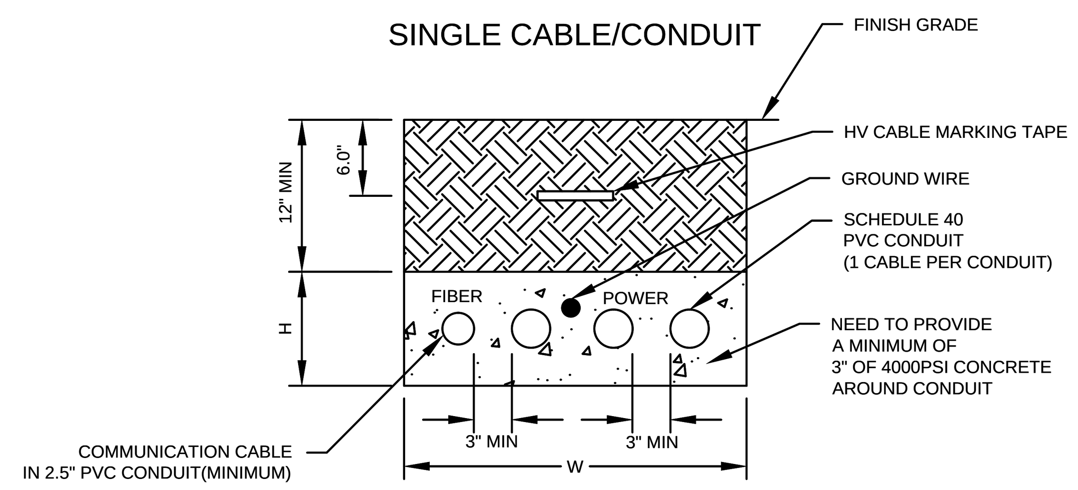
TRIPLEX CONDUCTORS



SIEVE SIZE	% PASSING
#4	100
#40	40-70
#200	0-5

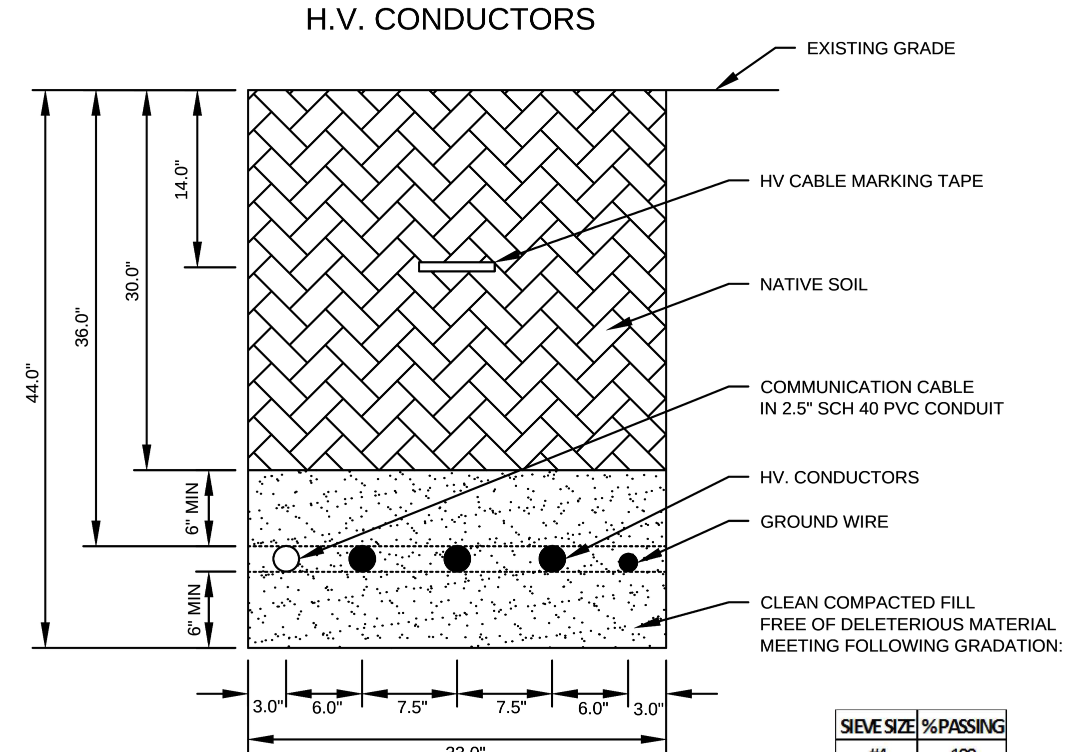
REDUCED DEPTH

SINGLE CABLE/CONDUIT



DIRECT BURIAL

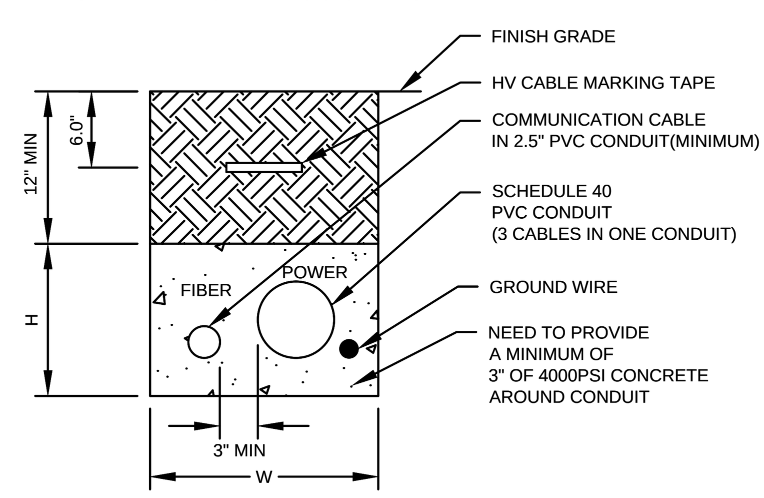
H.V. CONDUCTORS



SIEVE SIZE	% PASSING
#4	100
#40	40-70
#200	0-5

REDUCED DEPTH

MULTIPLE CABLE/CONDUIT



CABLE	REQ'D CONDUIT SIZE A	B
1/0	2"	4"
4/0	2.5"	5"
500 MCM	3"	6"
750 MCM	4"	8"

CONDUIT	MIN CONCRETE DIMENSIONS H	W (A)	W (B)
2"	9"	25"	--
2.5"	9"	28"	--
3"	10"	30"	--
4"	11"	35"	17"
5"	12"	--	18"
6"	13"	--	19"
8"	15"	--	21"

WILD MEADOWS WIND PROJECT
IBERDROLA RENEWABLES
ALEXANDRIA, DANBURY, &GRAFTON, NEW HAMPSHIRE
SCALE: NTS
SIZE: ARCH D
UNDER GROUND ELECTRIC DETAILS
CONDUIT TRENCH DETAILS & SECTIONS
DATE: 11/04/13
DRAWN BY: NRM
ENGN'D BY: DPE
PROJECT #: 22036
DRAWING #: E-113

RLC ENGINEERING
267 Whitten Road
Hallowell, ME 04347
Phone 207-621-1077
Fax 207-621-1177
www.rlc-eng.com

A | FOR PERMIT APPLICATION ONLY-NOT FOR CONSTRUCTION | 11/04/13 | NRM | ARH | DPE
REV | DESCRIPTION | DATE | DRWN | CHKD | APPVD

SEAL:

IBERDROLA RENEWABLES

NO. | DATE | REVISION DESCRIPTION | ENG | DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGN'D BY: RLC
DRAWN BY: RLC
CHECK'D BY: RLC
ARCHIVE #: H-5107

horizons Engineering Inc
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH
70 PERCENT DESIGN

SHEET TITLE: ELECTRICAL DETAILS
SHEET NUMBER: E 1.2

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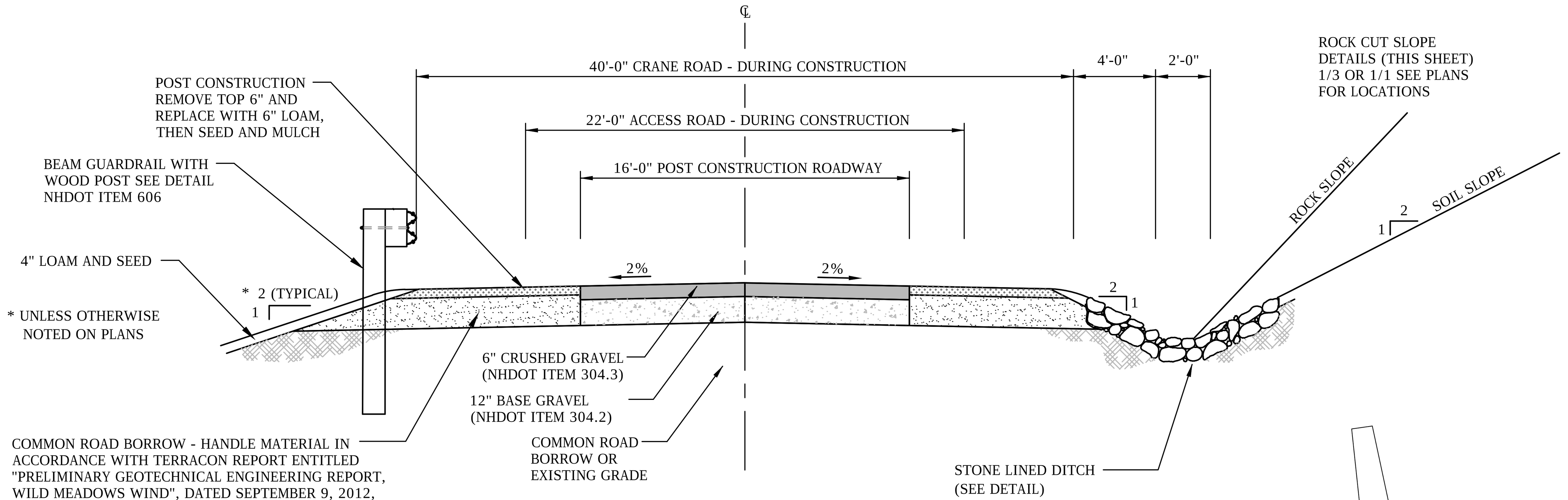
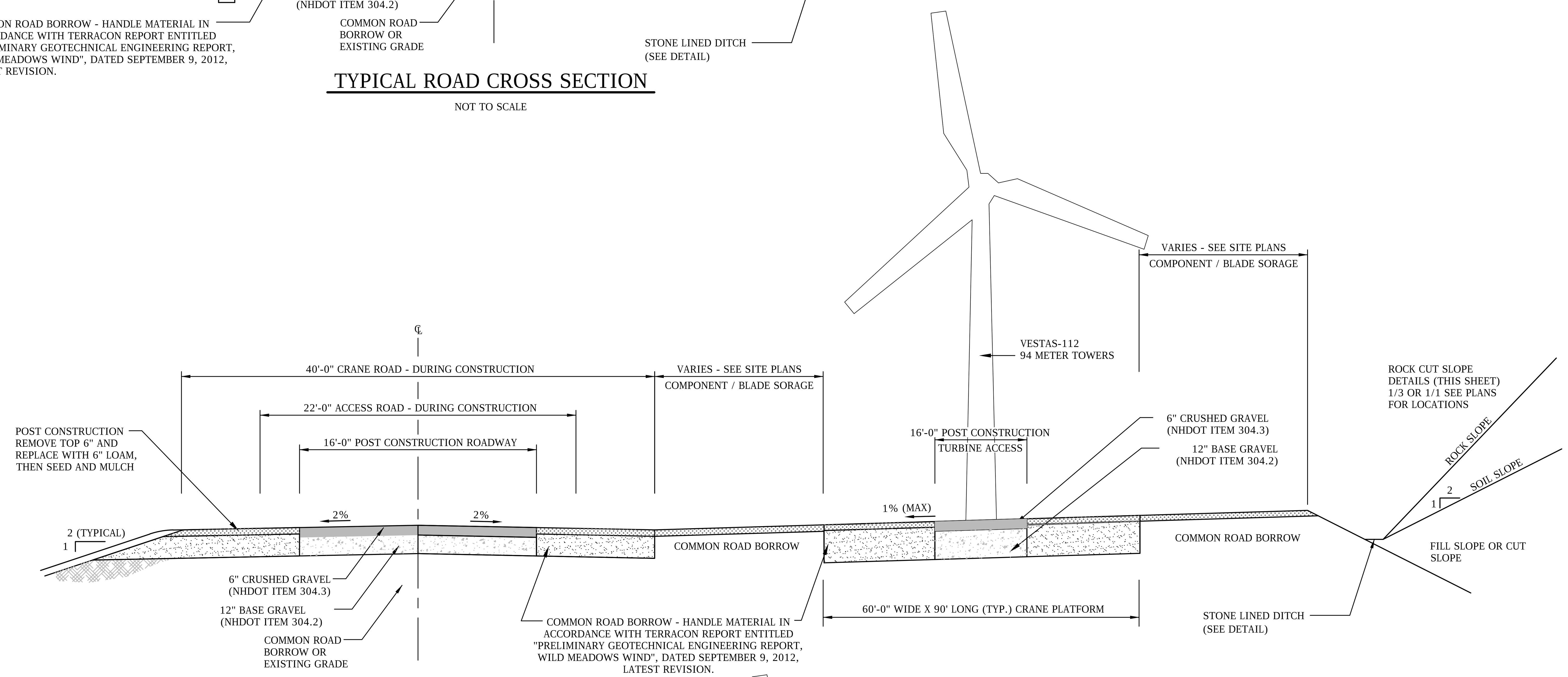


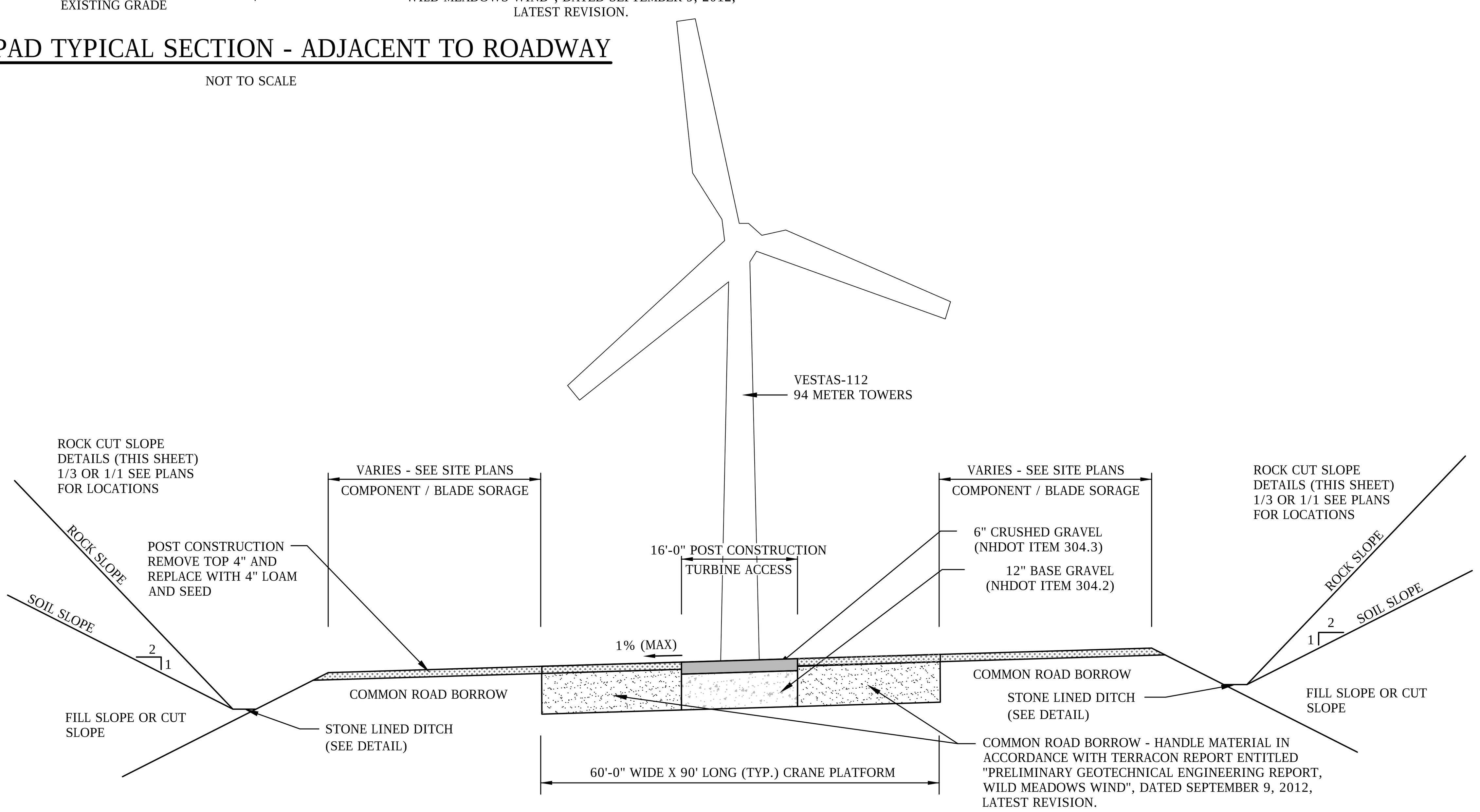
TYPICAL ROAD CROSS SECTION

NOT TO SCALE



CRANE PAD TYPICAL SECTION - ADJACENT TO ROADWAY

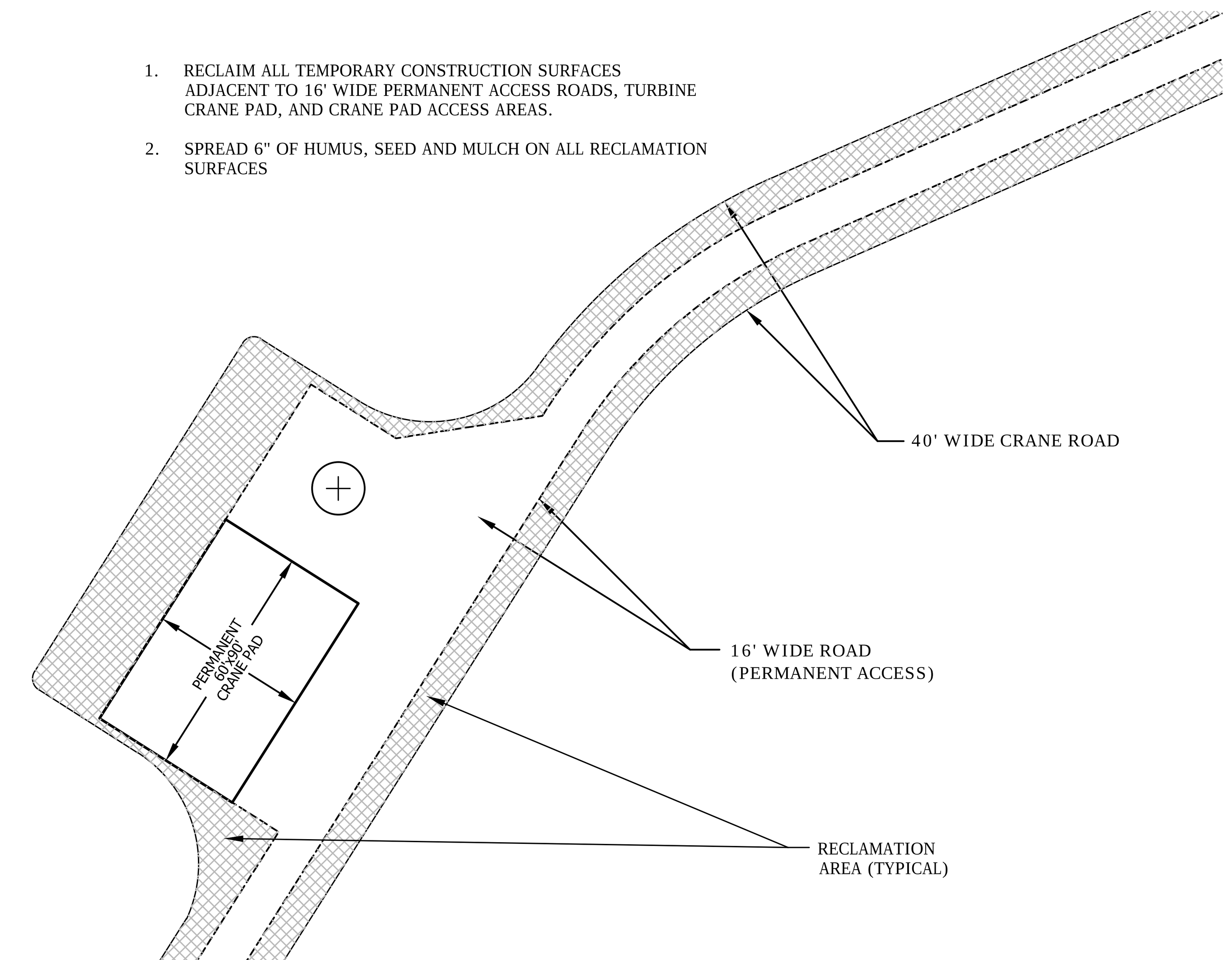
NOT TO SCALE



CRANE PAD TYPICAL SECTION - END OF ROADWAY

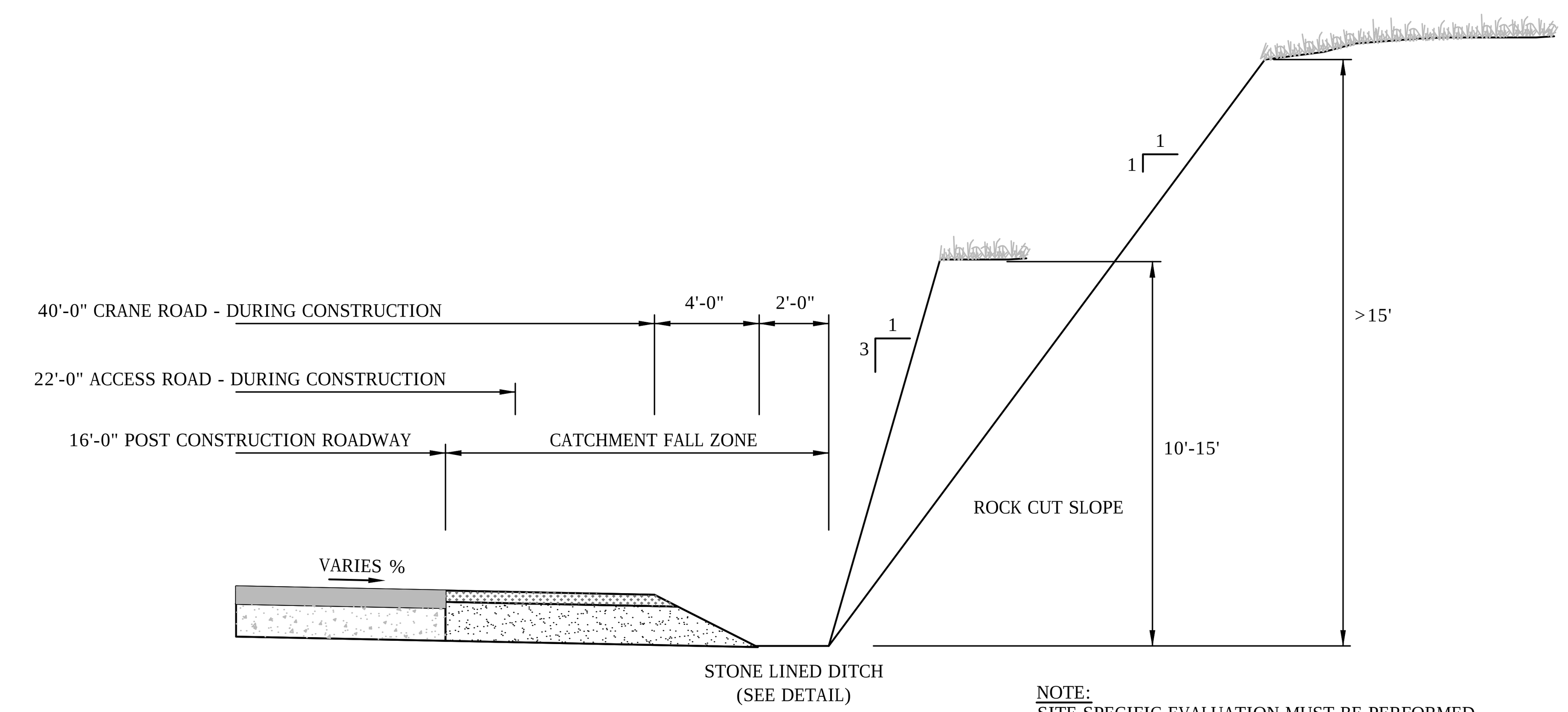
NOT TO SCALE

1. RECLAIM ALL TEMPORARY CONSTRUCTION SURFACES ADJACENT TO 16' WIDE PERMANENT ACCESS ROADS, TURBINE CRANE PAD, AND CRANE PAD ACCESS AREAS.
2. SPREAD 6" OF HUMUS, SEED AND MULCH ON ALL RECLAMATION SURFACES



POST CONSTRUCTION RECLAMATION DETAIL

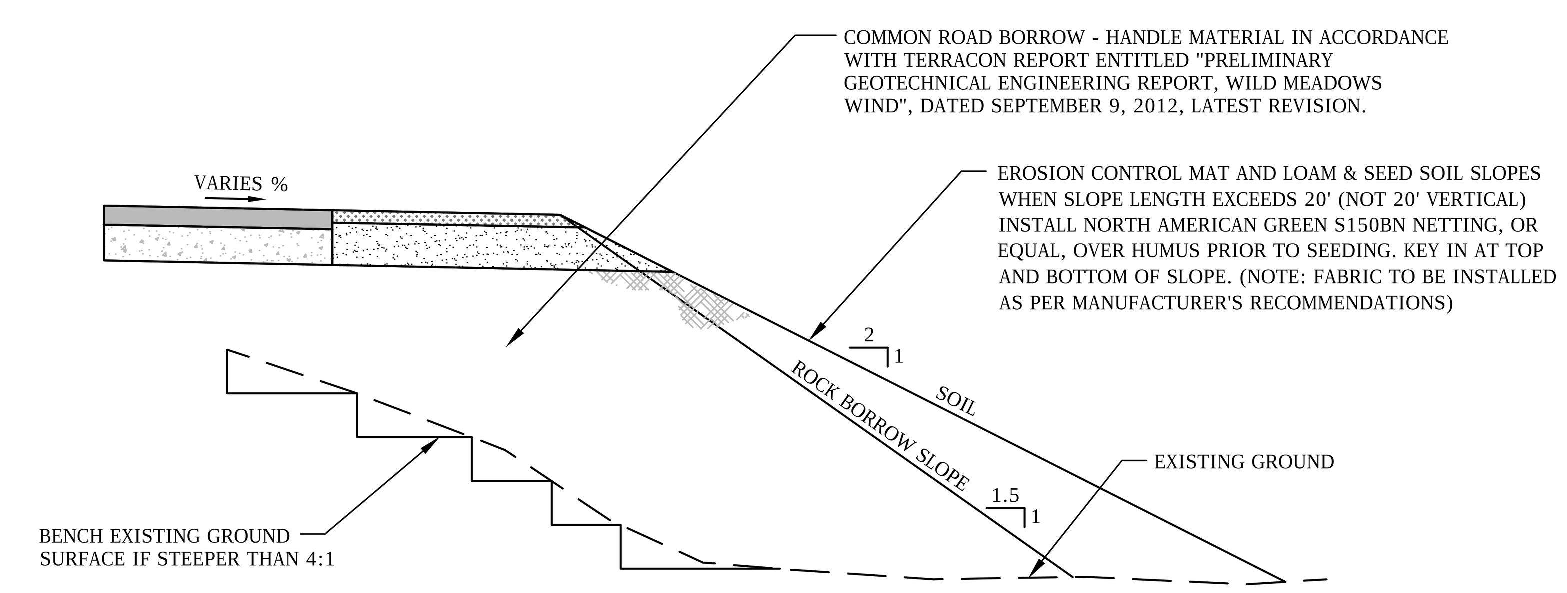
NOT TO SCALE



NOTE:
SITE SPECIFIC EVALUATION MUST BE PERFORMED BY CONTRACTOR'S ENGINEER AN APPROVED BY OWNER CONSIDERING THE BEDROCK CONDITIONS AND ORIENTATION OF STRIKE AND DIP IN RELATION TO SLOPE ORIENTATION

ROCK CUT DETAIL

NOT TO SCALE



FILL SLOPE DETAIL

NOT TO SCALE

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	SML
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 PROFESSIONAL ENGINEER 12/3/13

horizons Engineering Inc
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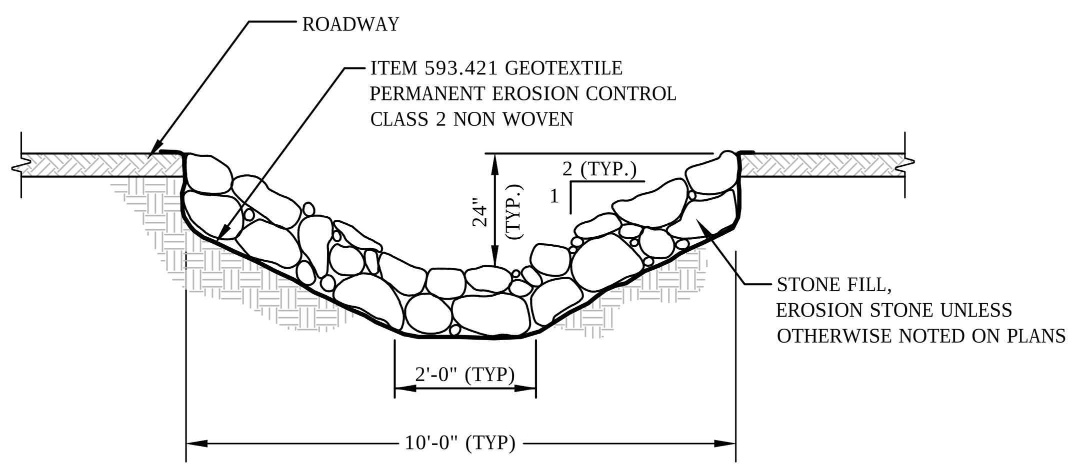
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: SITE DETAILS

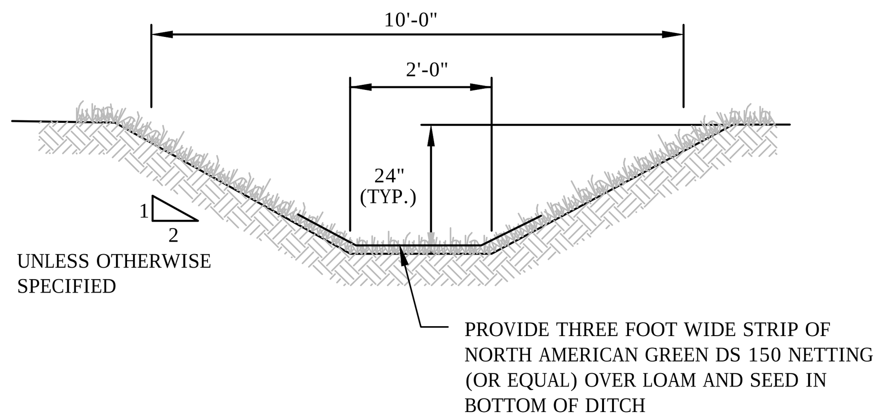
SHEET NUMBER: D 1.1



STONE LINED DITCH DETAIL

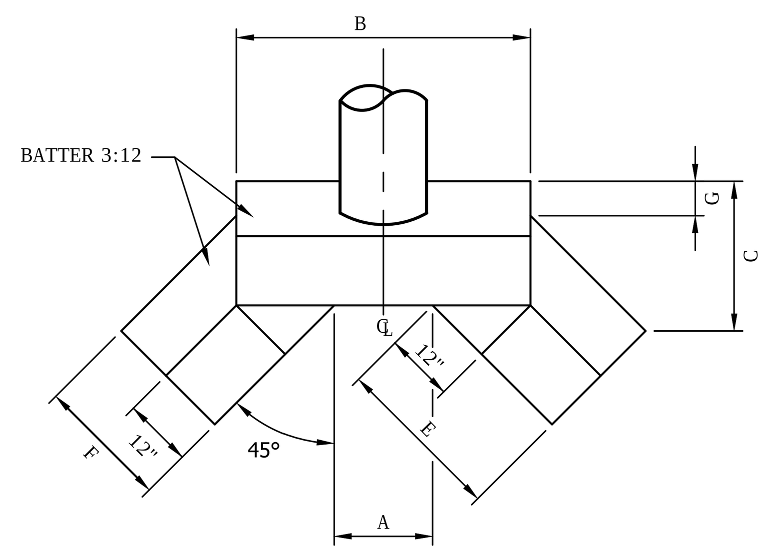
NOT TO SCALE

(APPLY TO ALL DITCHES OVER 5%)
(NOT APPLICABLE IN LEDGE AREAS)



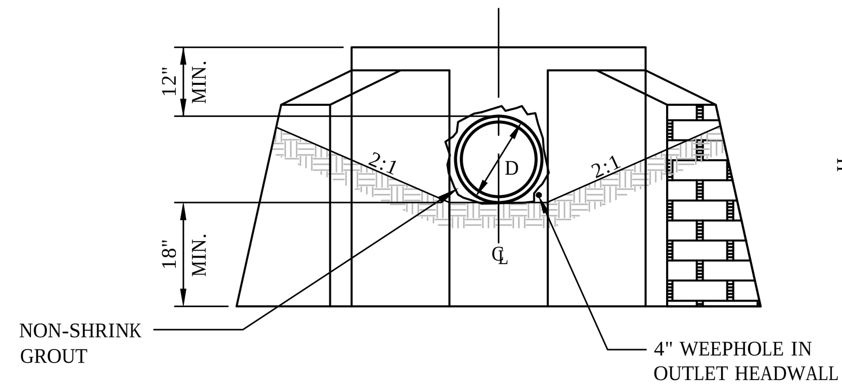
GRASS LINED DITCH DETAIL

NOT TO SCALE

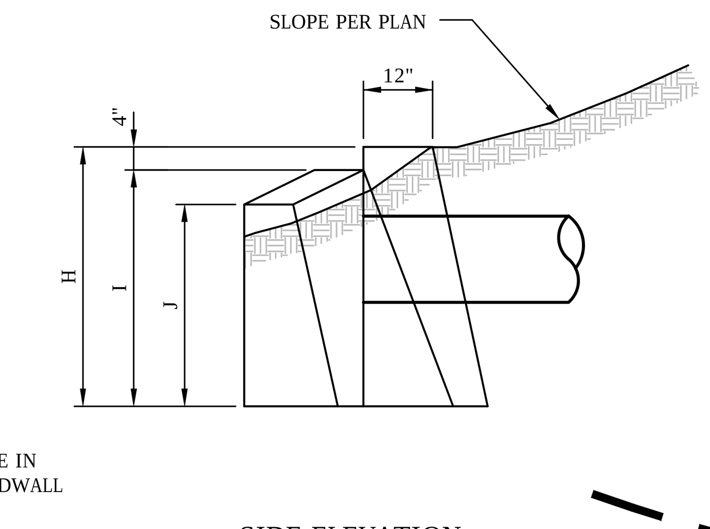


PLAN

DIMENSION TABLE					
MARK	DIMENSION	DIMENSION	DIMENSION	DIMENSION	DIMENSION
A	1'-3"	1'-6"	1'-9"	2'-3"	3'-3"
B	4'-0"	4'-3"	4'-6"	5'-0"	6'-0"
C	2'-2"	2'-2"	2'-2"	2'-2"	2'-2"
D	1'-0"	1'-3"	1'-6"	2'-0"	3'-0"
E	2'-4"	2'-4"	2'-4"	2'-4"	2'-4"
F	1'-11"	1'-11"	1'-11"	1'-11"	1'-11"
G	0'-6"	0'-6"	0'-6"	0'-6"	0'-6"
H	3'-6"	3'-9"	4'-0"	4'-6"	5'-6"
I	3'-2"	3'-5"	3'-8"	4'-2"	5'-2"
J	2'-11"	2'-11"	2'-11"	2'-11"	2'-11"

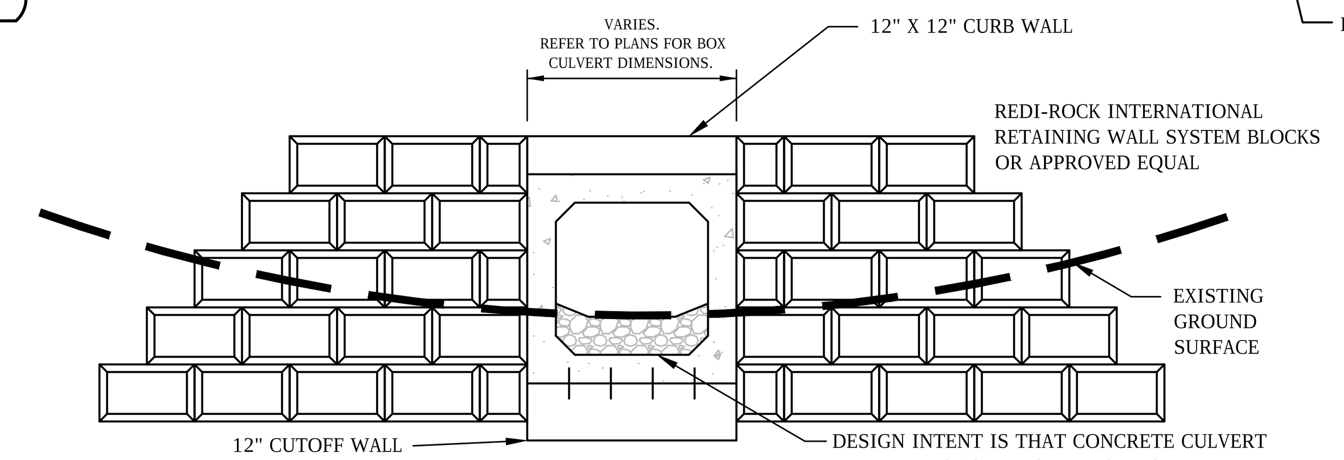


END ELEVATION



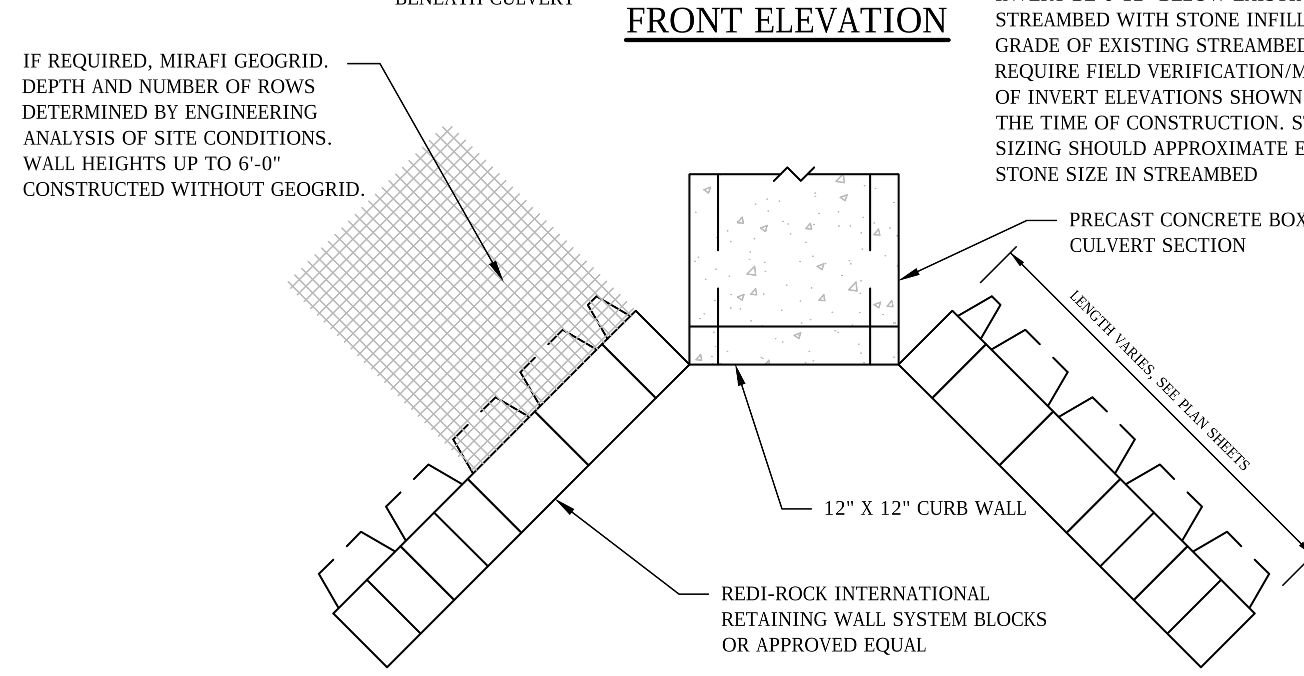
SIDE ELEVATION

STONE MASONRY HEADWALL DETAILS



FRONT ELEVATION

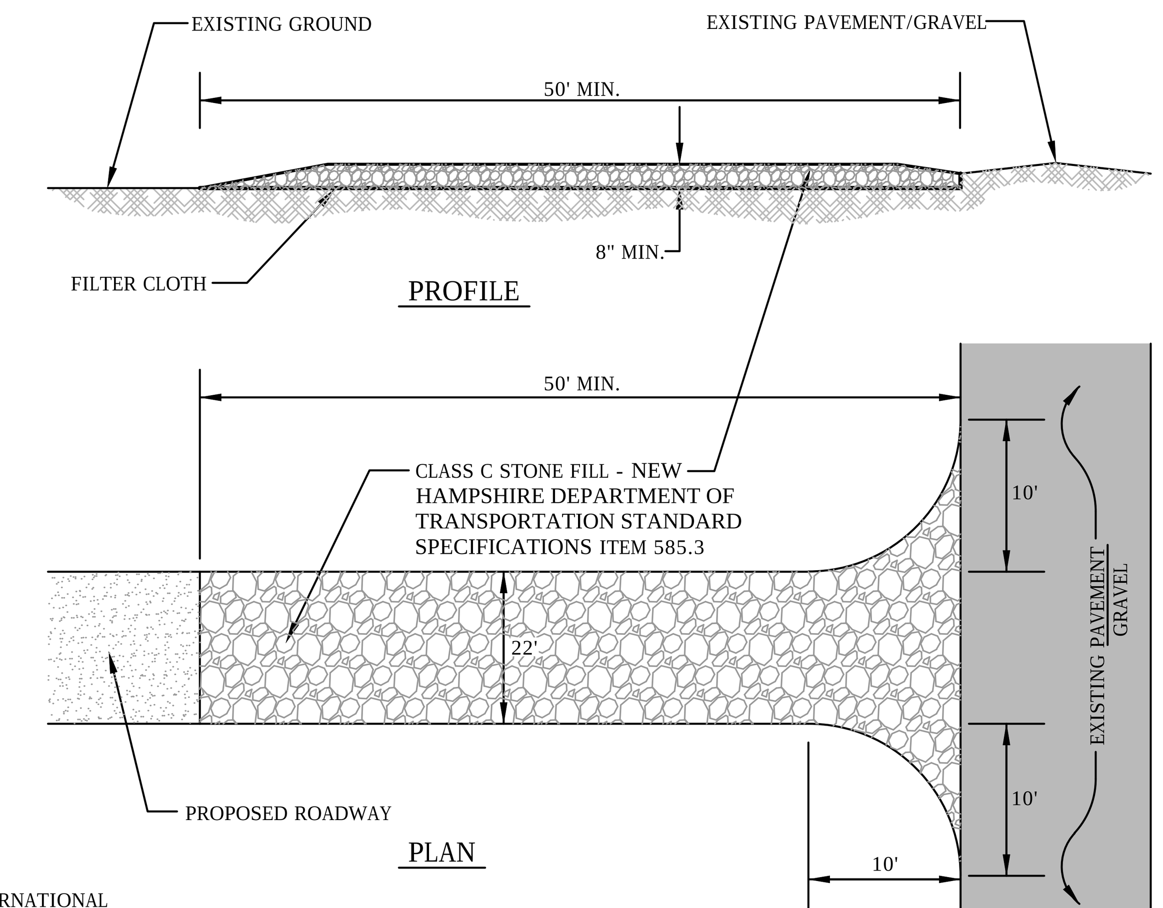
DESIGN INTENT IS THAT CONCRETE CULVERT INVERT BE 6-12" BELOW EXISTING STREAMBED WITH STONE INFILL TO MATCH GRADE OF EXISTING STREAMBED. THIS MAY REQUIRE FIELD VERIFICATION/MODIFICATION OF INVERT ELEVATIONS SHOWN ON PLANS AT THE TIME OF CONSTRUCTION. STONE INFILL SIZING SHOULD APPROXIMATE EXISTING STONE SIZE IN STREAMBED



PLAN VIEW

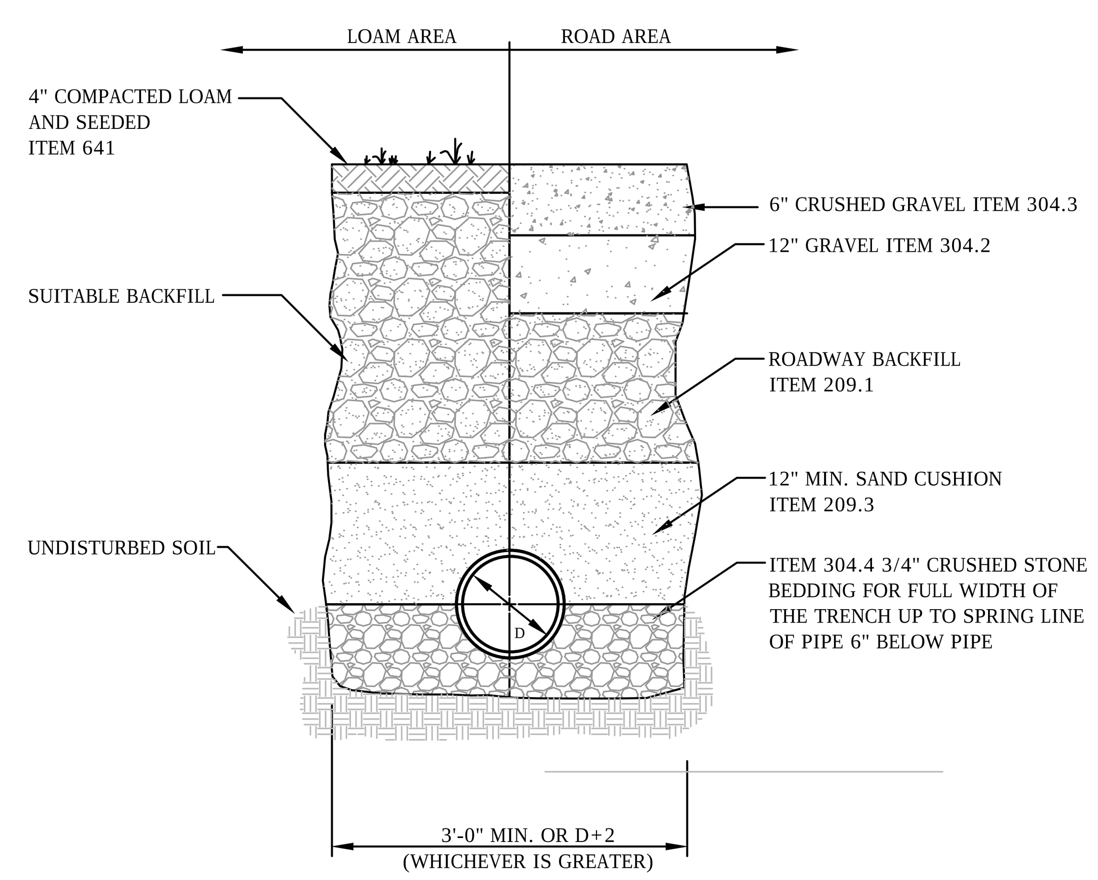
PRECAST CONCRETE BOX CULVERT WITH REDI-ROCK WING WALLS (TYPICAL)

NOT TO SCALE



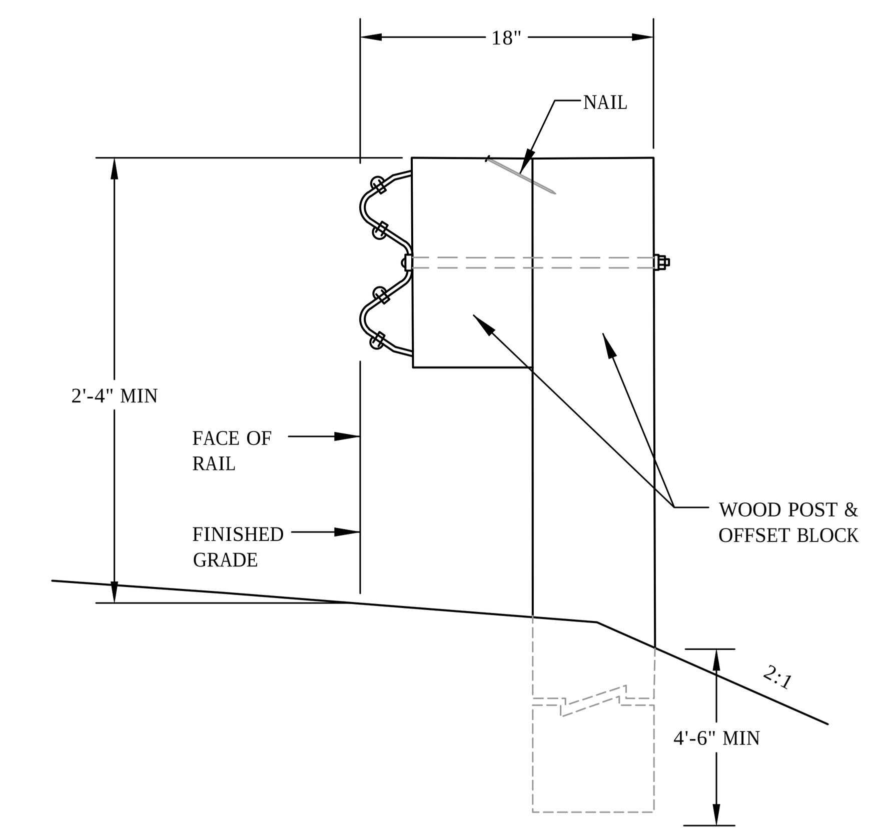
STABILIZED CONSTRUCTION ENTRANCE

NOT TO SCALE



TYPICAL DRAINAGE TRENCH DETAIL

NOT TO SCALE

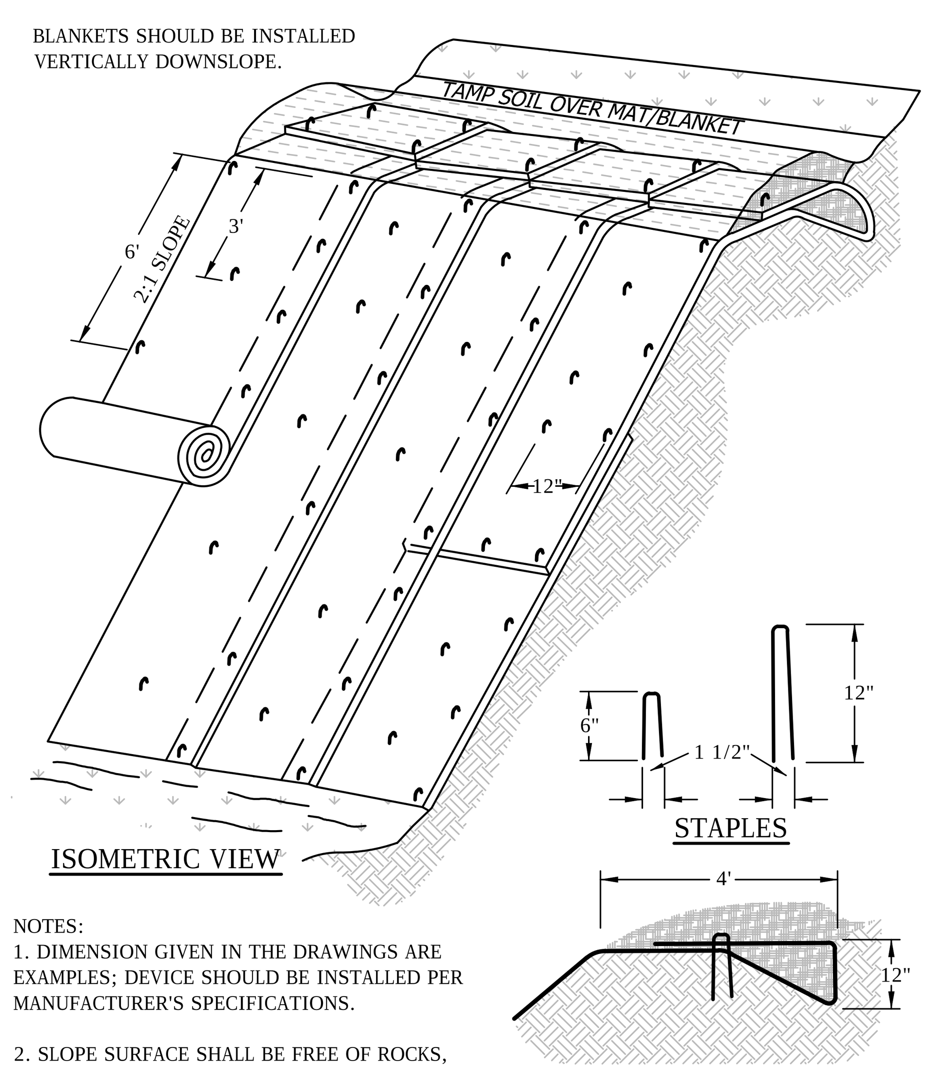


BEAM GUARDRAIL / WOOD POSTS

PER NHDOT SPECIFICATIONS
ITEM NO. 606

GUARDRAIL TO BE UTILIZED ON:
SLOPES GREATER THAN 3:1 WITH SLOPE HEIGHTS OF 15 FEET OR MORE
SLOPES GREATER THAN 2:1 WITH SLOPE HEIGHTS OF 6 FEET OR MORE

NOTE: THE CONTRACTOR HAS THE OPTION TO PLACE BOULDERS IN-LIEU OF GUARDRAIL IN TURBINE PAD AREAS AND ON STRAIGHT SECTIONS OF ROADWAY. LOCATIONS AND SIZES MUST BE APPROVED BY THE OWNER AND OWNER'S ENGINEER.



ISOMETRIC VIEW

STAPLES

NOTES:
1. DIMENSION GIVEN IN THE DRAWINGS ARE EXAMPLES; DEVICE SHOULD BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS.

2. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/BLANKETS SHALL HAVE GOOD SOIL CONTACT.

3. APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.

4. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.

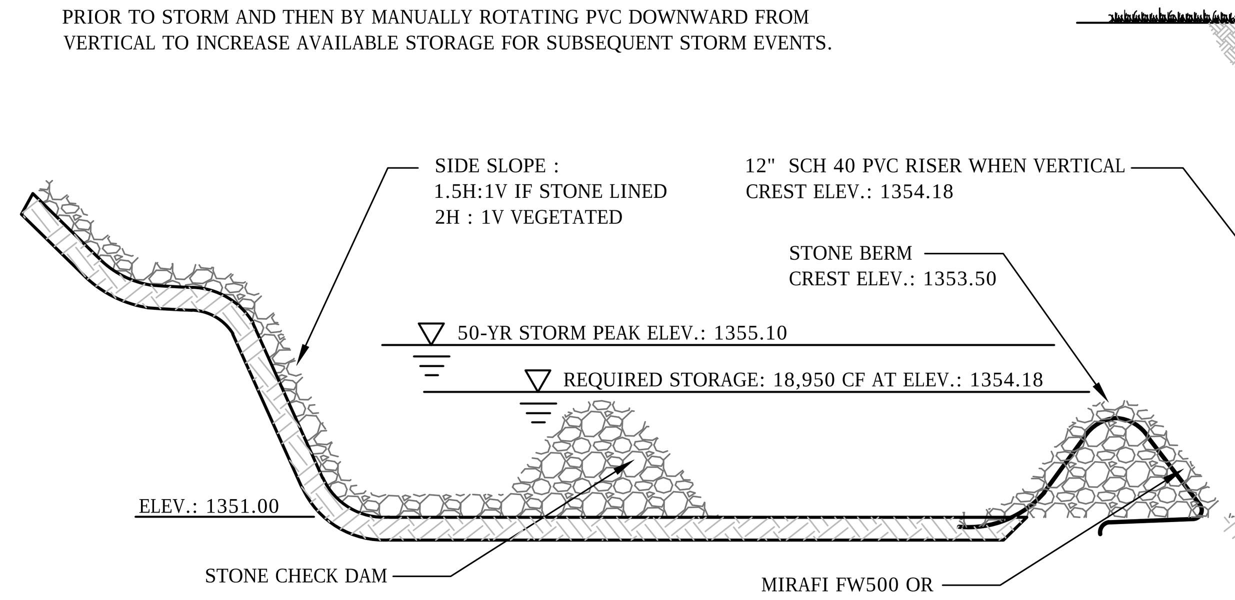
DETAIL DIGITIZED FROM NEW HAMPSHIRE STORMWATER MANUAL, VOLUME 3, NHDES 2008

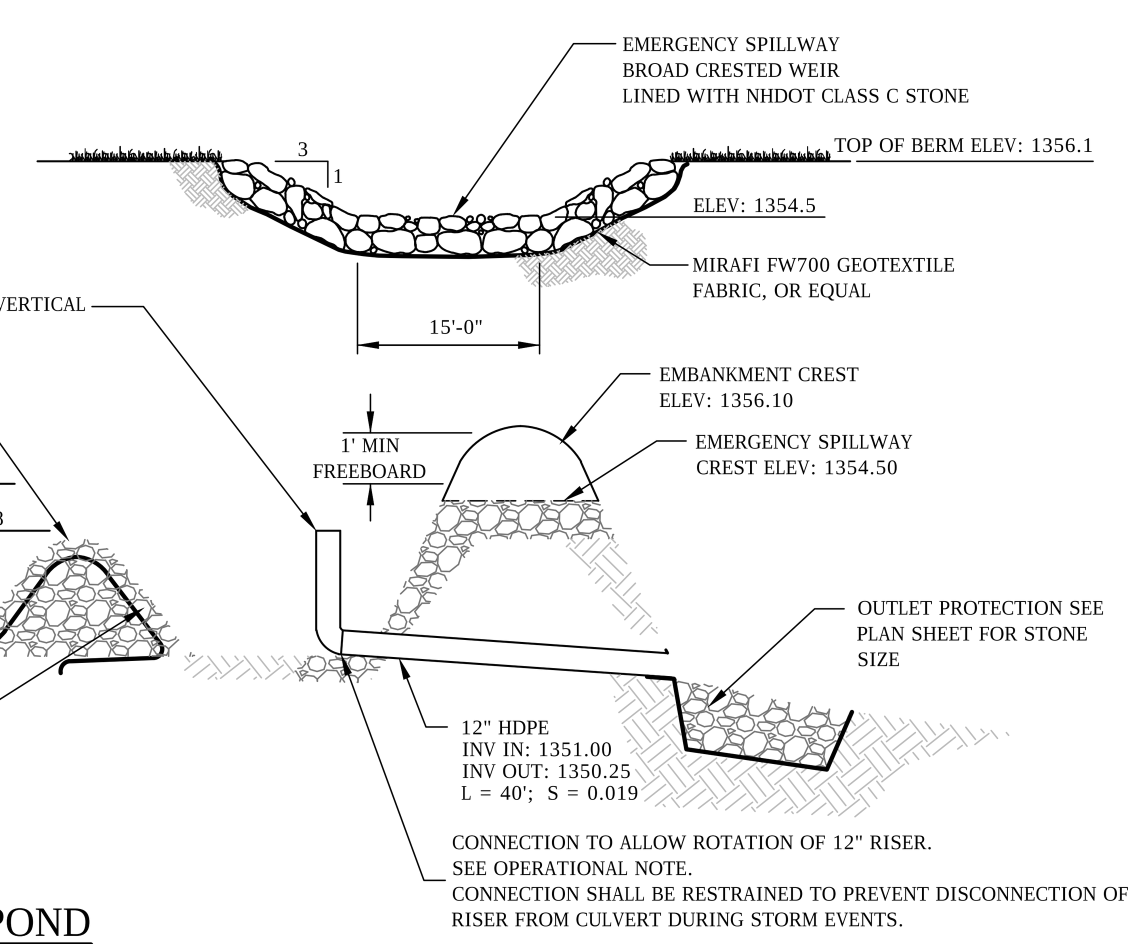
EROSION CONTROL BLANKET INSTALLATION DETAIL

NOT TO SCALE

EROSION CONTROL BLANKET SHALL BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS

OPERATIONAL NOTE
DESIGN OBJECTIVE OF OUTLET IS TO MEET EPA REQUIREMENT OF SURFACE WITHDRAWL WHILE STILL ALLOWING FOR DRAWDOWN OF STORMWATER IN BETWEEN STORMS. THIS IS ACCOMPLISHED BY ROTATING 12" PVC VERTICALLY PRIOR TO STORM AND THEN BY MANUALLY ROTATING PVC DOWNWARD FROM VERTICAL TO INCREASE AVAILABLE STORAGE FOR SUBSEQUENT STORM EVENTS.

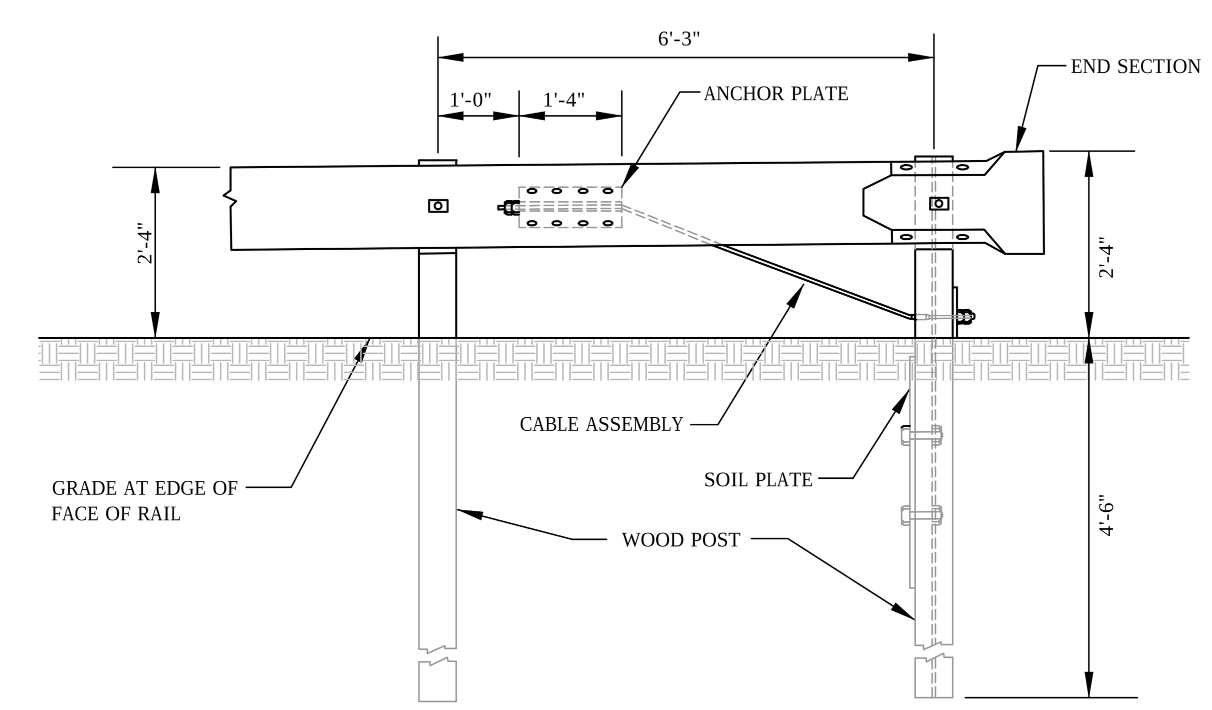




CONNECTION TO ALLOW ROTATION OF 12" RISER. SEE OPERATIONAL NOTE.
CONNECTION SHALL BE RESTRAINED TO PREVENT DISCONNECTION OF RISER FROM CULVERT DURING STORM EVENTS.

O&M AREA SEDIMENT POND

NOT TO SCALE



TERMINAL UNIT TYPE G-2

PER NHDOT SPECIFICATIONS
ITEM NO. 606

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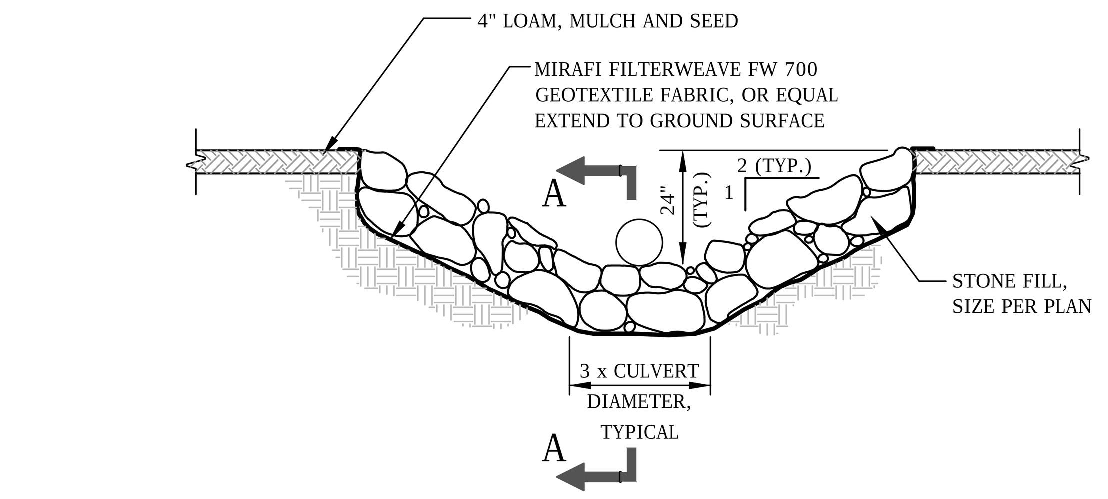
horizons Engineering Inc
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

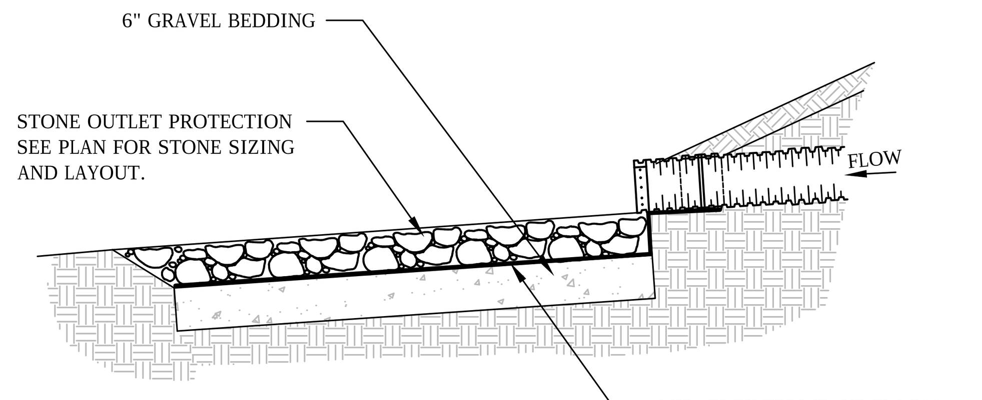
SHEET TITLE: SITE DETAILS

SHEET NUMBER: D 1.2

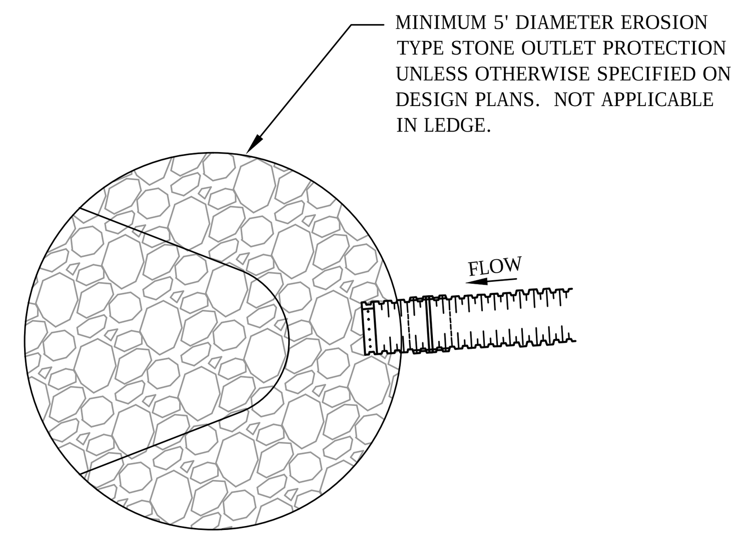


STONE DEPTH TABLE:
USED FOR OUTLET PROTECTION

TYPE	SIZE	DEPTH
CLASS A	28+"	42"
CLASS B	12"-28"	36"
EROSION	4.2"-12"	18"
CLASS C	0"-4.2"	12"



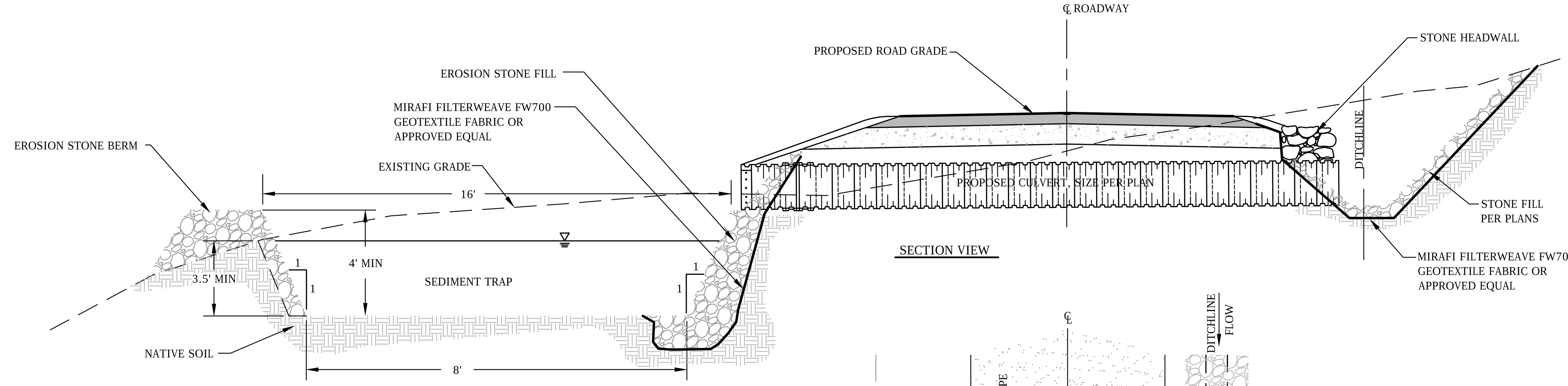
SECTION A-A



PLAN

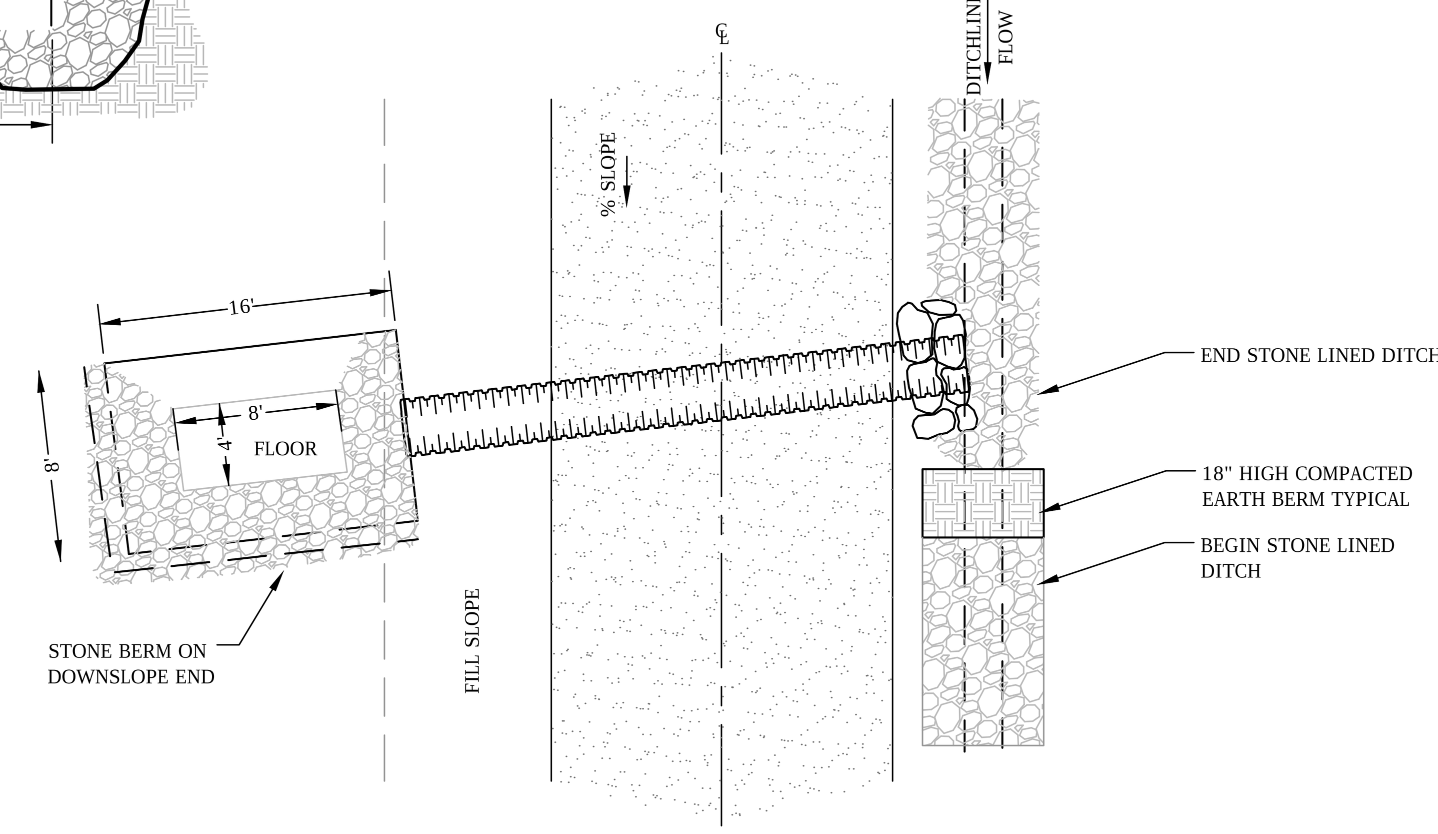
STONE LINED OUTLET DETAIL

NOT TO SCALE



LEVEL LIP SPREADER INSTALLATION

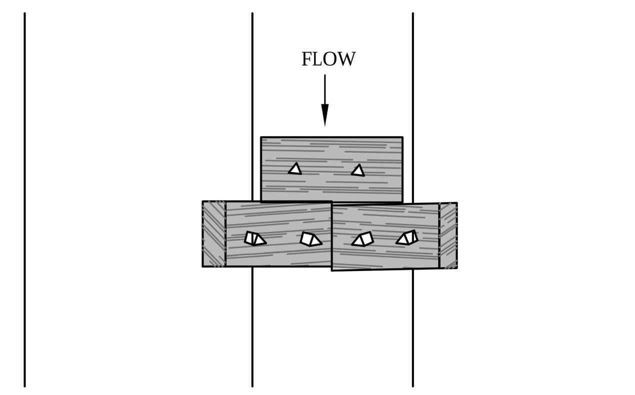
1. CONSTRUCT THE LEVEL SPREADER LIP ON A ZERO PERCENT GRADE TO INSURE UNIFORM SPREADING OF RUNOFF.
2. LEVEL SPREADER SHALL BE CONSTRUCTED ON UNDISTURBED SOIL AND NOT ON FILL NOR ON EXISTING GRADES IN EXCESS OF 15%.
3. STONE BERMED LEVEL SPREADERS SHALL NOT BE INSTALLED IN WETLANDS SOILS OR IN HYDROLIC SOILS GROUP D.
4. THE ENTIRE LEVEL LIP AREA SHALL BE PROTECTED BY PLACING A 3 FOOT WIDE BY 6" DEEP TROUGH AND A 2 FOOT WIDE BY 15" HIGH STONE BERM FOR THE LENTGH OF THE IMPERVIOUS AREA OR FOR A MINIMUM OF 10 FEET.
5. THE ENTRANCE CHANNEL TO THE LEVEL SPREADER SHALL NOT EXCEED A 1 PERCENT GRADE FOR AT LEAST 50 FEET BEFORE ENTERING INTO THE SPREADER.
6. THE FLOW FROM THE LEVEL SPREADER SHALL OUTLET ONTO STABILIZED AREAS. WATER SHOULD NOT RE-CONCENTRATE IMMEDIATELY BELOW THE SPREADER.
7. PERIODIC INSPECTION AND REQUIRED MAINTENANCE SHALL BE PERFORMED.



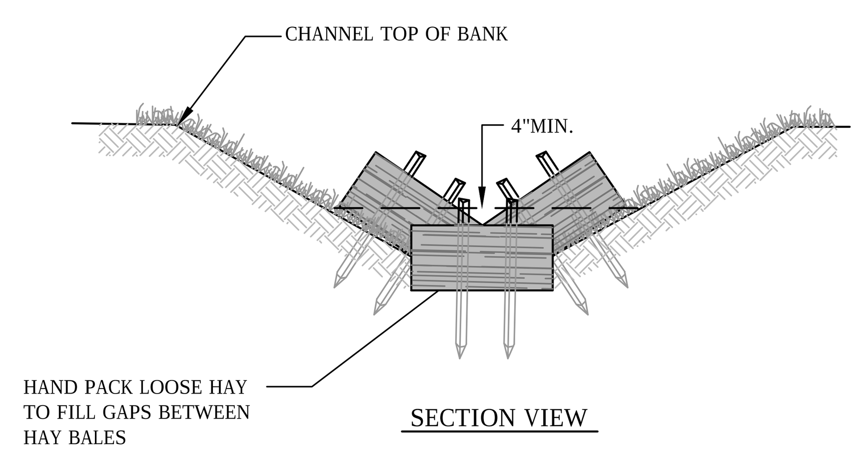
PLAN VIEW

SEDIMENT TRAP DETAIL (ST)

NOT TO SCALE



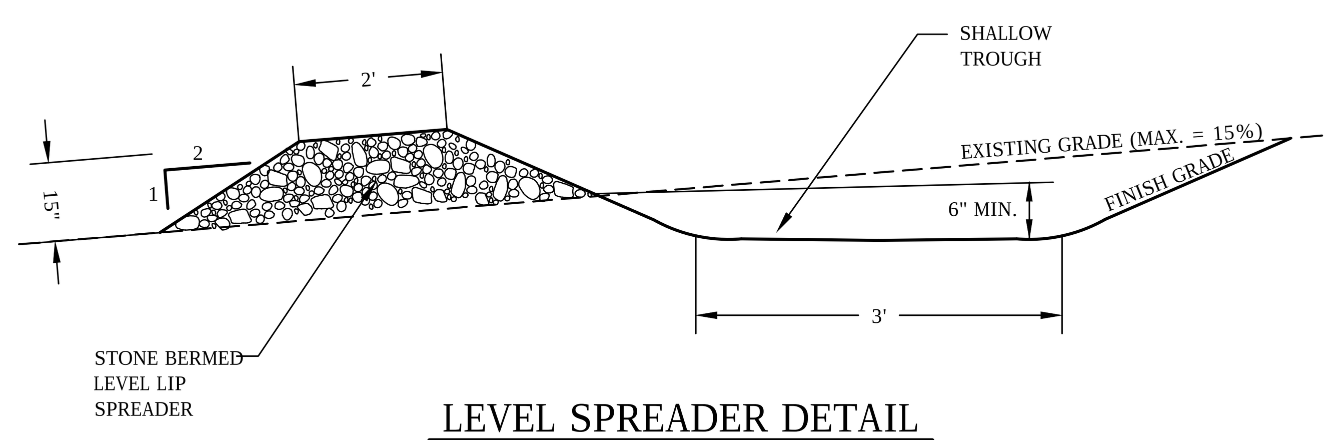
PLAN VIEW



SECTION VIEW

HAY BALE CHECK DAM (HCD)

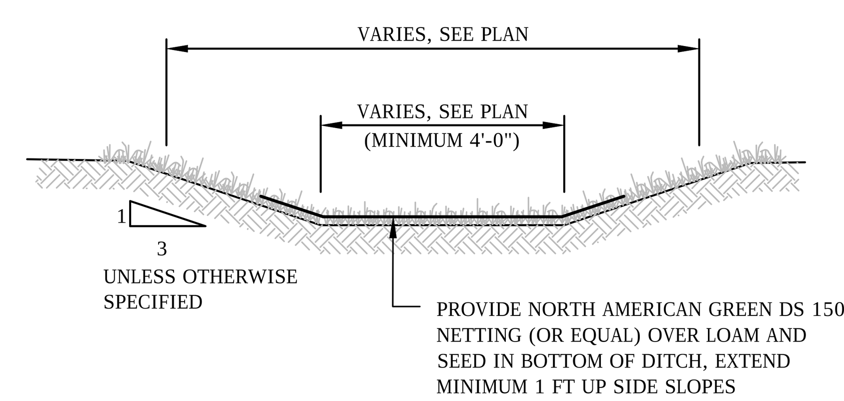
NOT TO SCALE



LEVEL SPREADER DETAIL

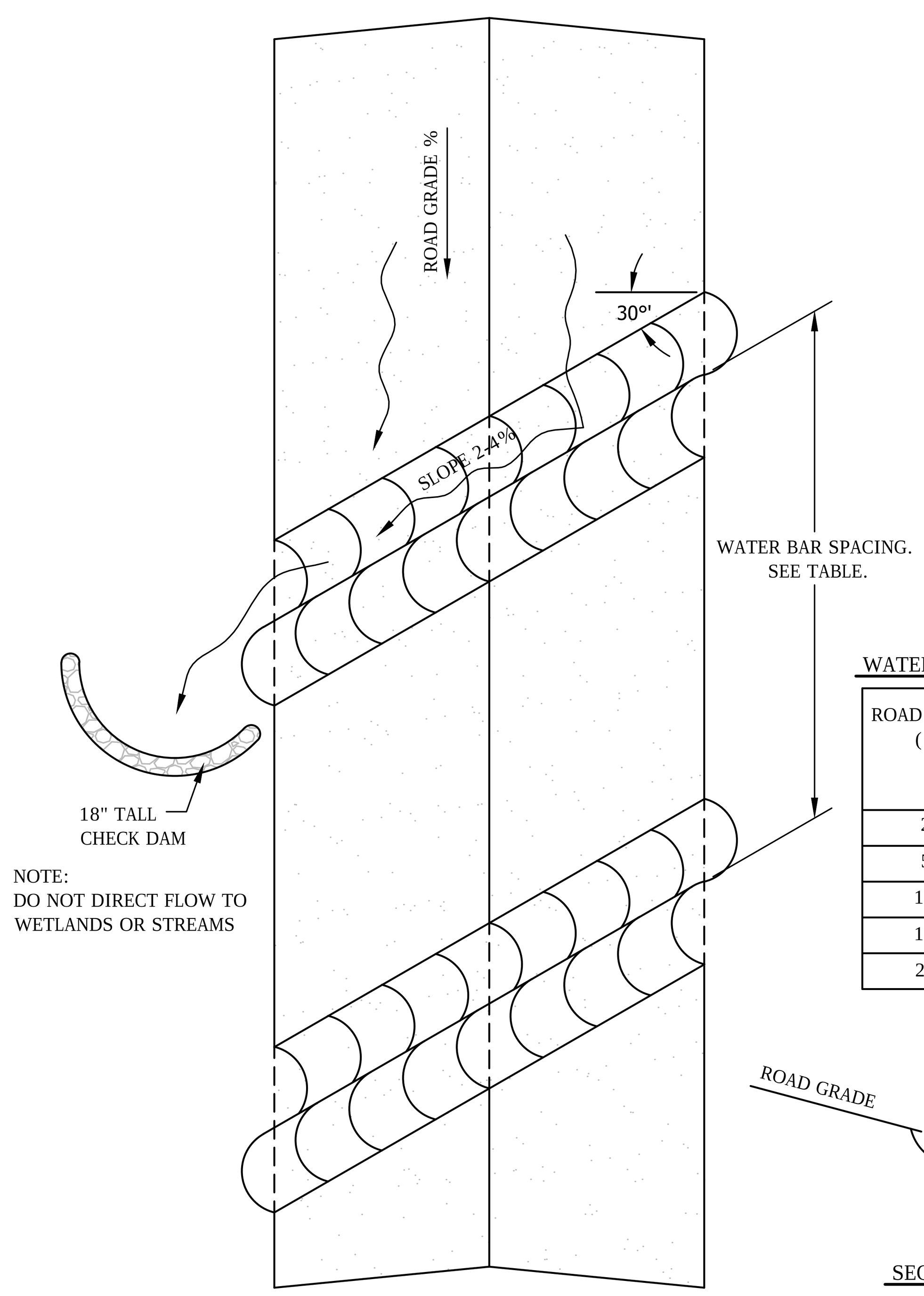
NOT TO SCALE

SOURCE: ROCKINGHAM COUNTY CONSERVATION SERVICE



TREATMENT SWALE DETAIL

NOT TO SCALE

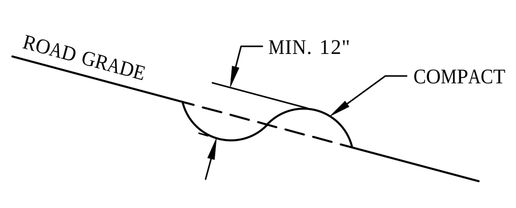


NOTE:
DO NOT DIRECT FLOW TO WETLANDS OR STREAMS

PLAN VIEW

WATER BAR SPACING TABLE

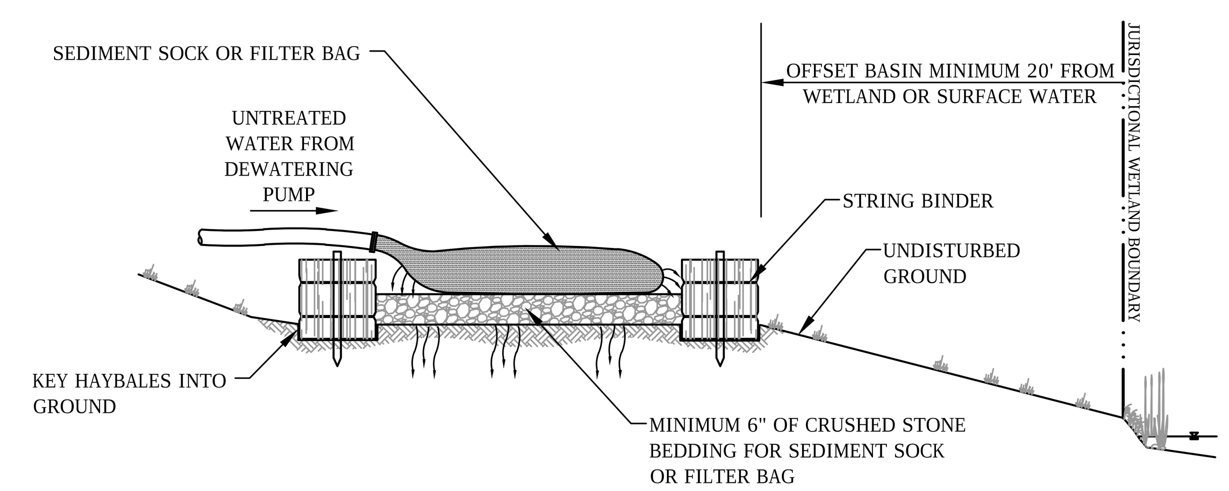
ROAD GRADE (%)	DISTANCE BETWEEN WATER BARS (FT)
2	250
5	135
10	80
15	60
20	50



SECTION VIEW

WATER BAR DETAIL

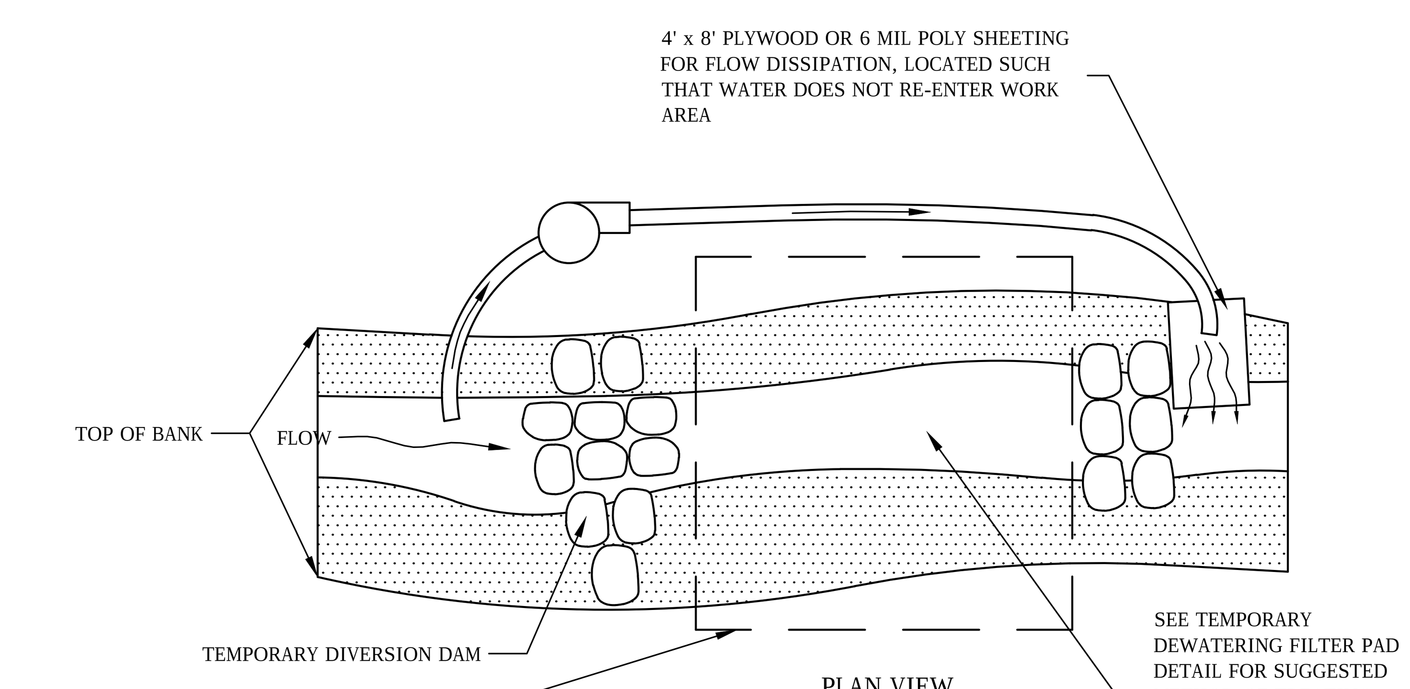
NOT TO SCALE



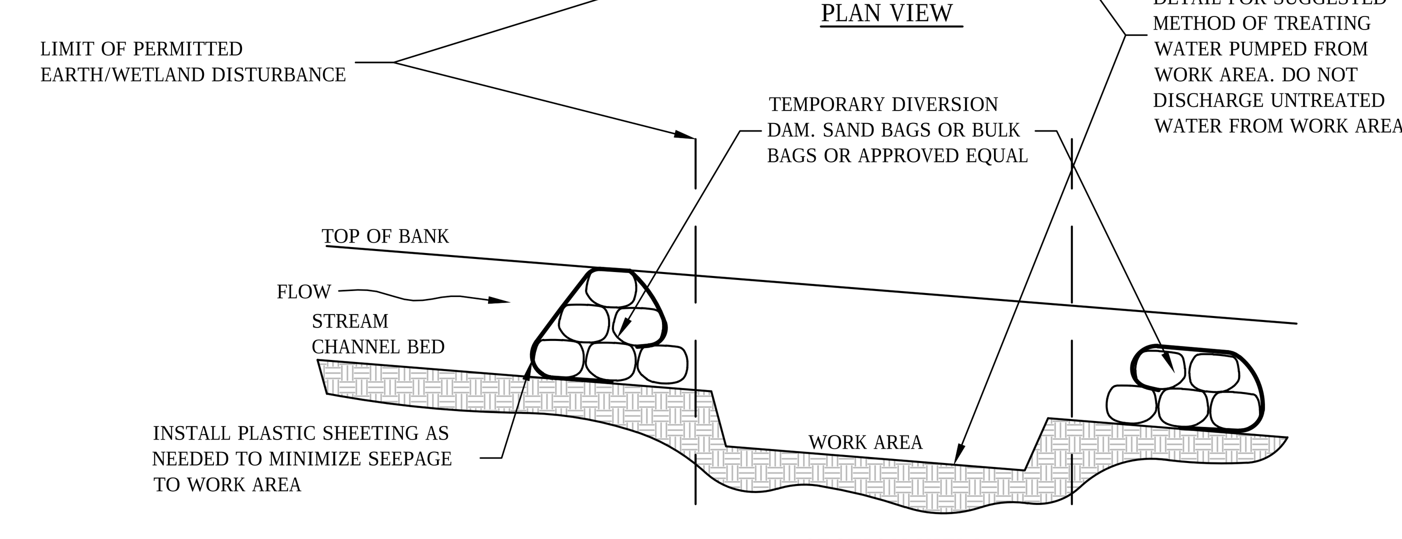
NOTE:
1. DESIGN INTENT FOR TEMPORARY DEWATERING FILTER PAD IS TO ENHANCE PUMP WATER QUALITY PRIOR TO INFILTRATION INTO UNDISTURBED GROUND.
2. CONTRACTOR TO OPERATE PUMPS AND SIZE TEMPORARY DEWATERING FILTER PAD TO ENCOURAGE INFILTRATION AND PREVENT DISCHARGE TO SURFACE WATERS OR WETLANDS. USE ADDITIONAL SEDIMENT CONTROLS AS NEEDED
3. COVERAGE UNDER EPA'S CONSTRUCTION DEWATERING GENERAL PERMIT OR CONSTRUCTION GENERAL PERMIT MUST BE OBTAINED IF DEWATERING ACTIVITIES RESULT IN A DISCHARGE TO SURFACE WATERS OR WETLANDS.

TEMPORARY DEWATERING FILTER PAD DETAIL

NO SCALE



PLAN VIEW



SECTION VIEW

NOTE: PERFORM STREAM WORK DURING PERIODS OF LOW FLOW -- REFER TO SWPPP

WORK AREA STREAM BYPASS DETAIL

NOT TO SCALE

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
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CHECK'D BY: TBP
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No. 13828
PROFESSIONAL ENGINEER
11/21/13

horizons Engineering inc
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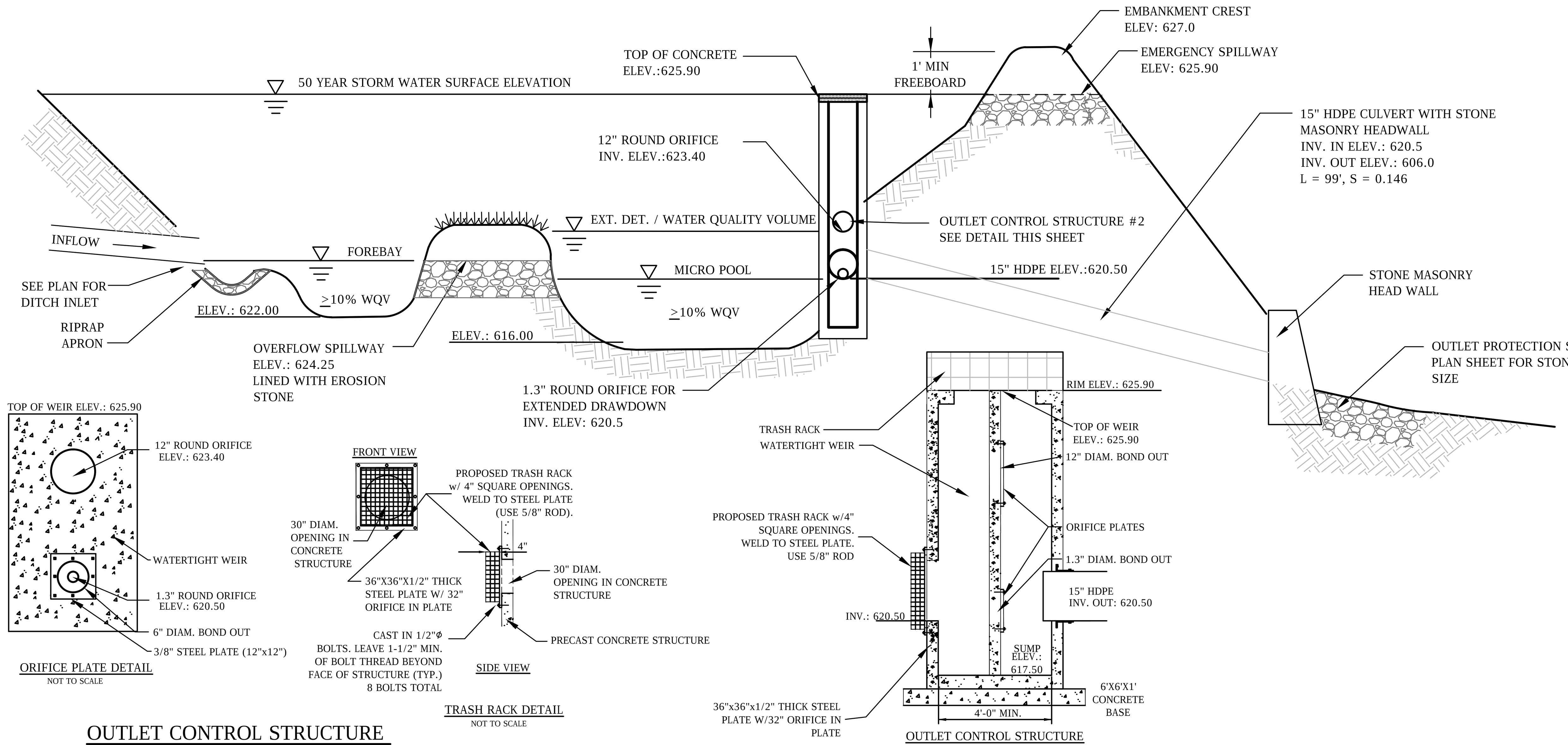
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: SITE DETAILS

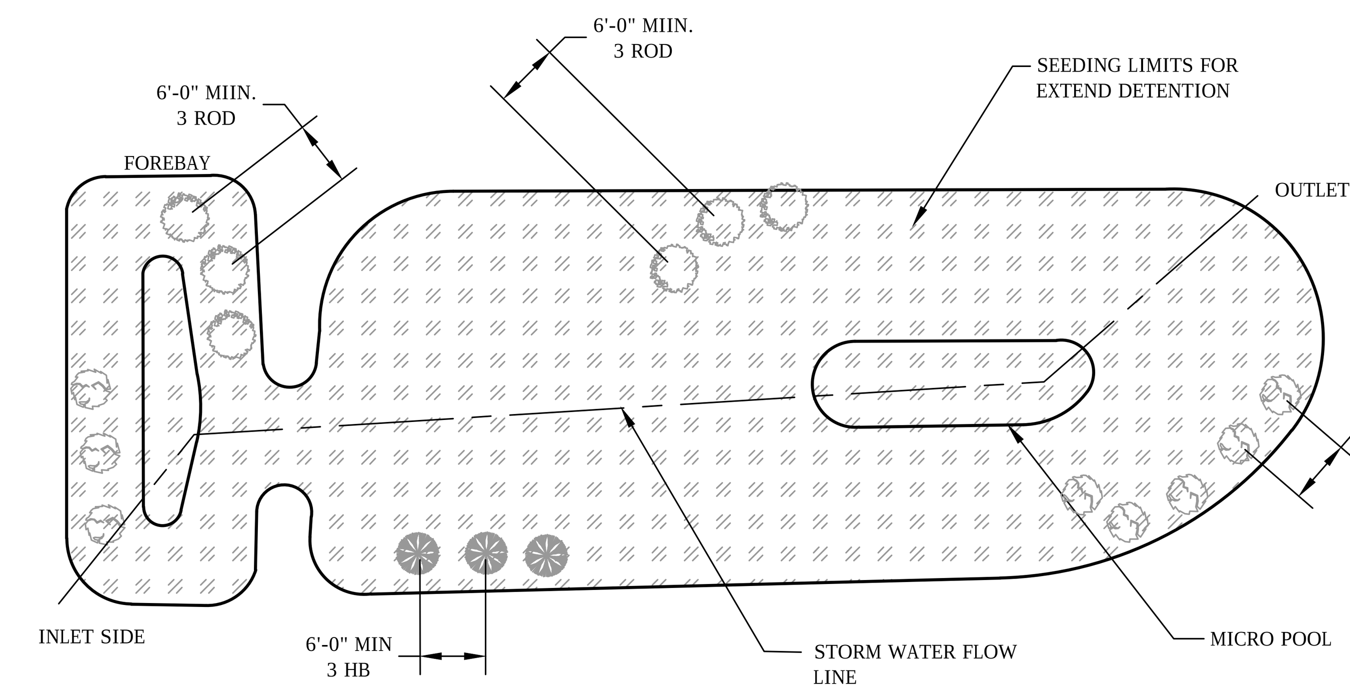
SHEET NUMBER: D 1.3



OUTLET CONTROL STRUCTURE

INTERCONNECTION STATION
MICROPOOL EXTENDED
DETENTION POND MP1

NOT TO SCALE



SHRUB PLANT SPACING

MICROPOOL EXTENDED DETENTION POND SEEDING RATES:

	SPECIES	TOTAL IN %	POUNDS PER ACRE
OBL	BAILEYS SEDGE	10%	5
	TUCKERMANS SEDGE	5%	2.5
	TUSSOCK SEDGE	5%	2.5
	BLUEFLAG IRIS	10%	2.5
	CANADA RUSH	5%	2.5
	PICKERAL WEED	2 LBS	1
FACW	WOOL GRASS	10%	5
FAC	OHIO SPIDER WORT	5%	4
	CONSERVATION MIX	50%	25
			50

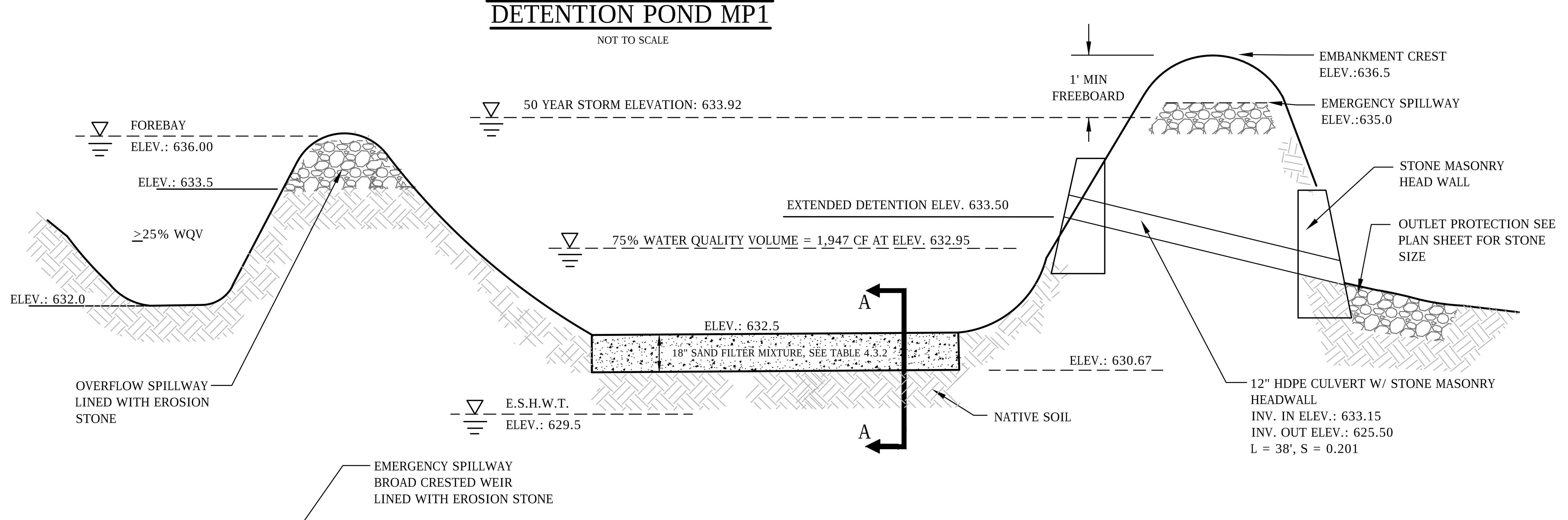
SEED ENTIRE POND INCLUDING FLOOR BOTTOM
SEEDING MIX AVAILABLE FROM "ERNST SEEDS",
MEADVILLE, PA, 800-873-3321 OR EQUAL

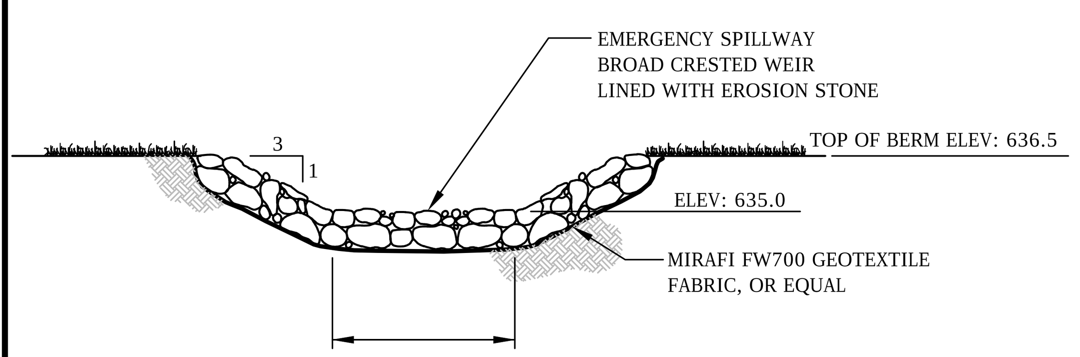
SHRUB PLANTING LIST

HB	HIGH BUSH BLUEBERRY	1GAL/CONT
AC	VIBURNUM (AMERICAN CRANBERRY)	1GAL/CONT
ROD	RED OSIER DOGWOOD	1GAL/CONT

INTERCONNECTION STATION MICROPOOL EXTENDED DETENTION POND ,
FOREBAY AND OUTLET PLANTING PLAN

NOT TO SCALE





SUBSTATION SURFACE SAND
FILTRATION POND INF1

NOT TO SCALE

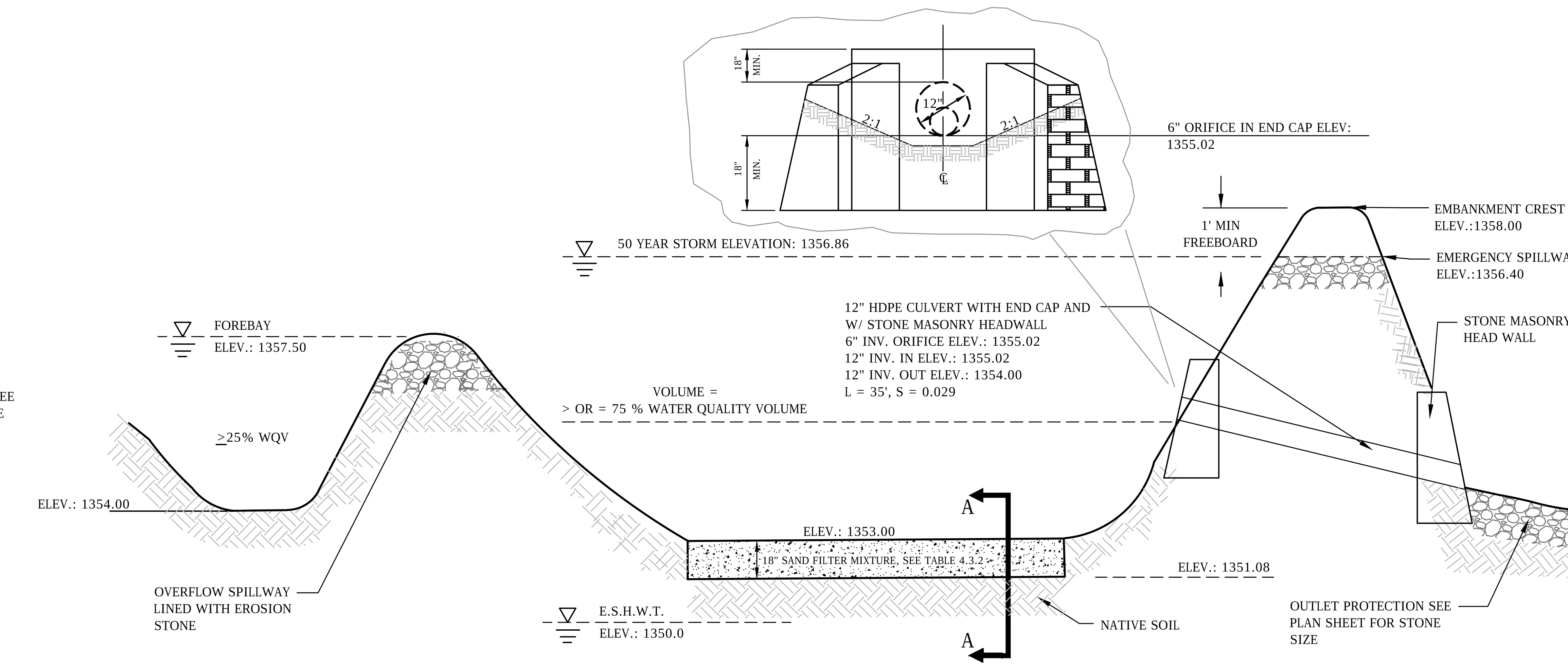
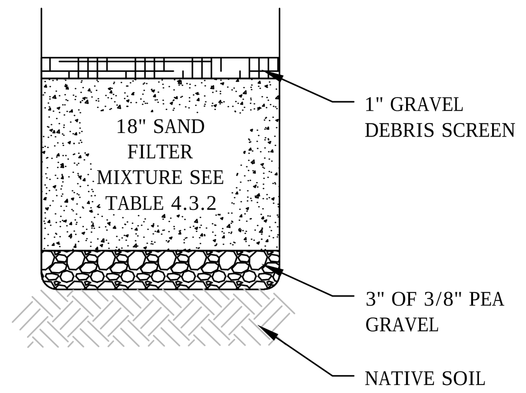
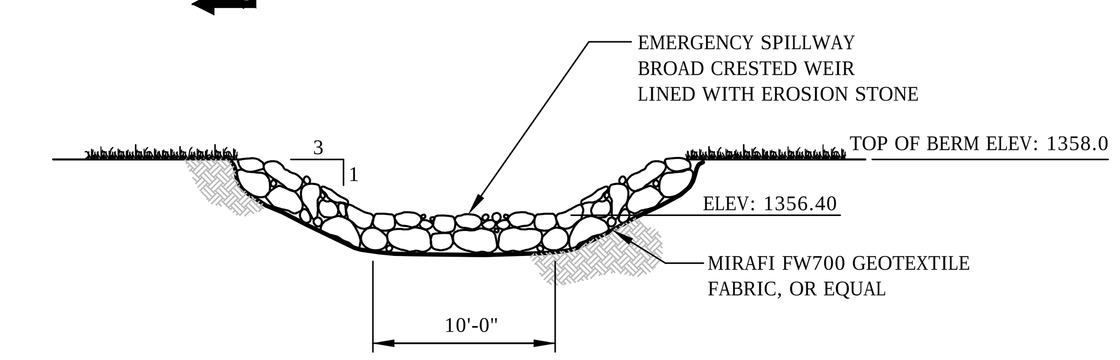


Table 4.3.2. Sand Filter Mixtures

Component Material	Percent of Mixture by Volume	Gradation of Material: Sieve No.	Gradation of Material: Percent by Weight Passing Standard Sieve
ASTM C-33 Concrete Sand	50 to 55		
Loamy sand topsoil, with fines as indicated	20 to 30	200	15 to 25
Moderately fine shredded bark or wood fiber mulch, with fines as indicated	20 to 30	200	< 5

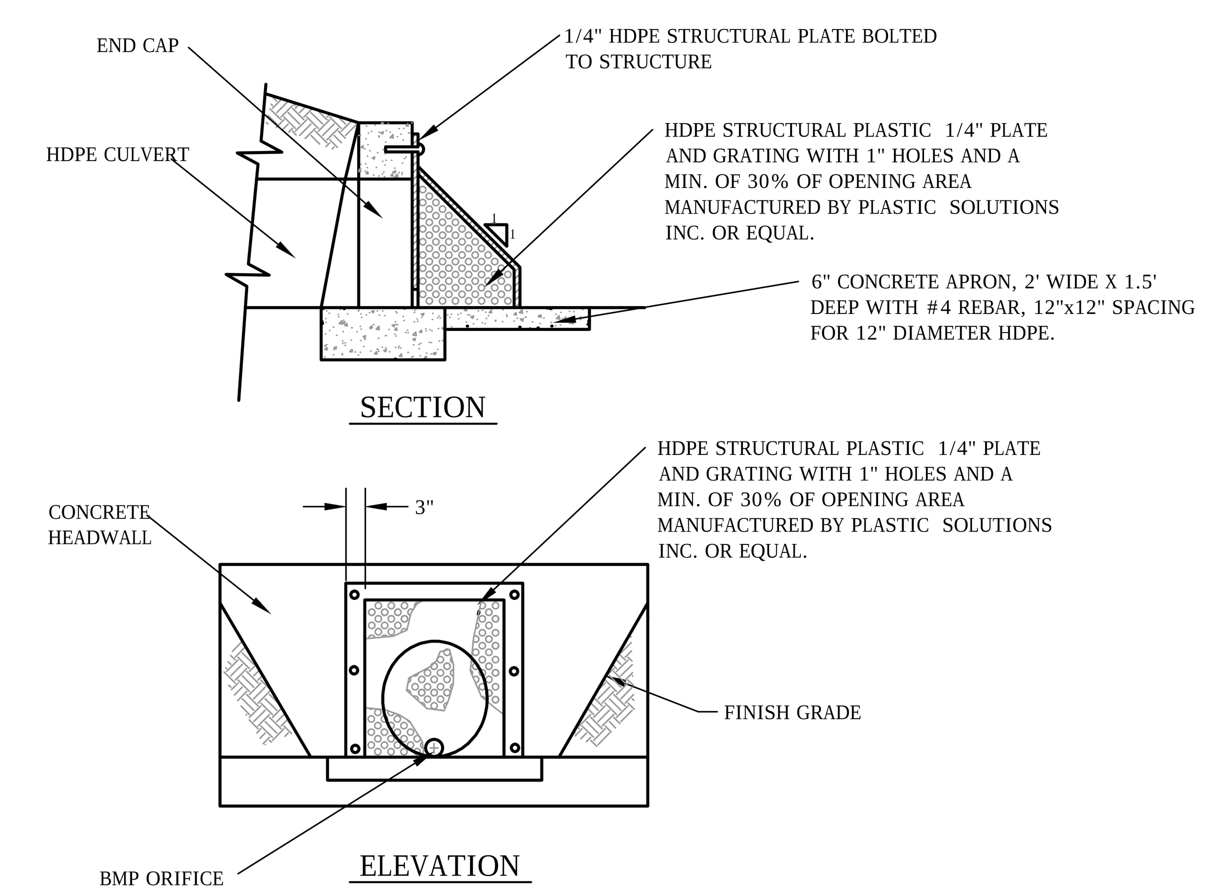


SECTION A-A



O&M BUILDING SURFACE SAND FILTRATION POND

NOT TO SCALE



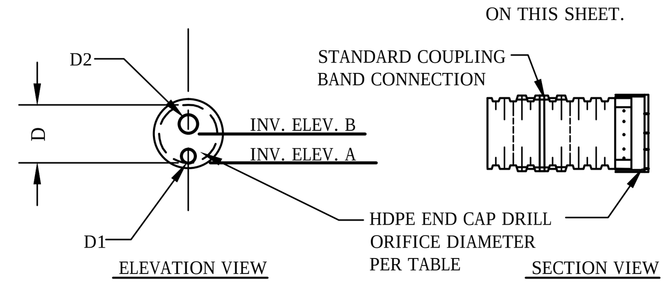
HDPE DEBRIS CAGE DETAIL

NOT TO SCALE

DIMENSIONS TABLE POND ORIFICE

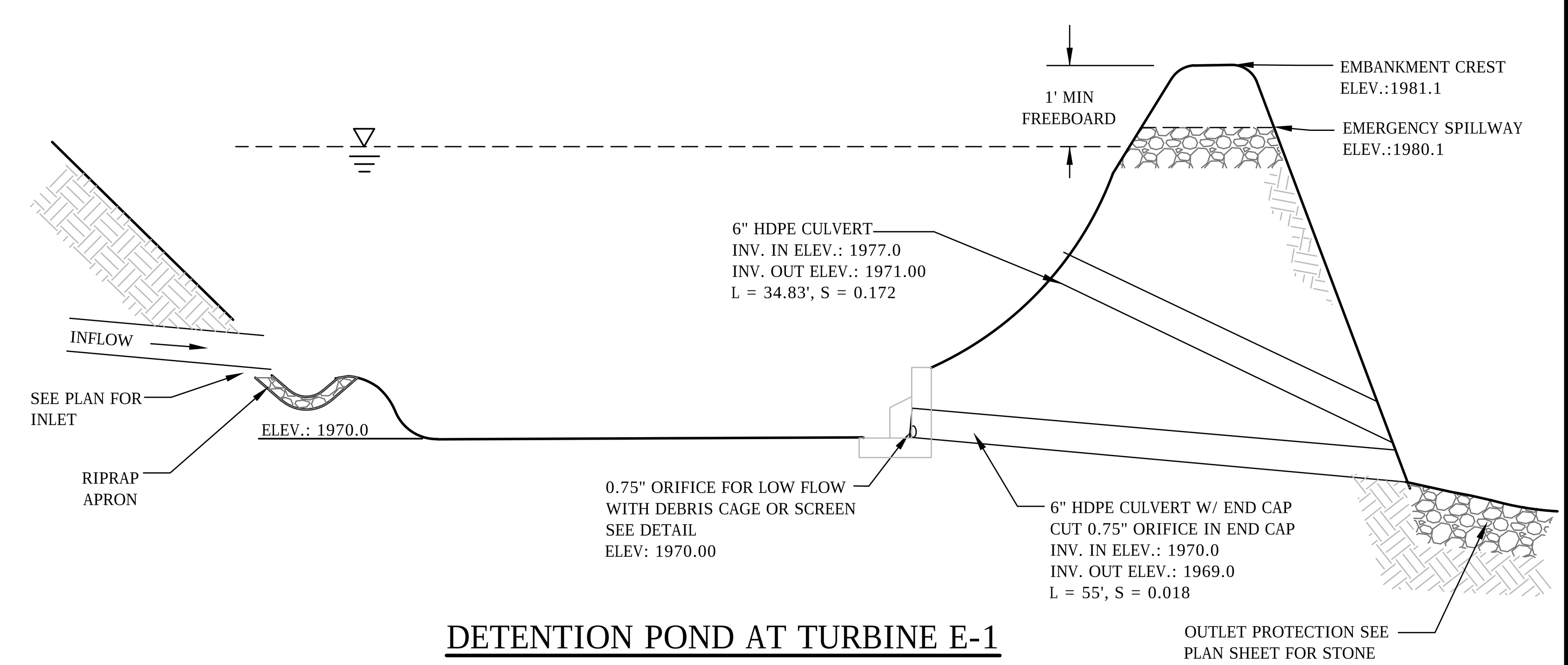
POND NO.	D (IN.)	D1 (IN.)	D2 (IN.)	ELEV A	ELEV B
DETENTION POND 13P	6	0.75	N/A	1970.0	1970.0
O&M FILTRATION POND	12	6.0	N/A	1355.02	N/A

NOTE: HDPE ORIFICE PLATES LES THAN 6" IN DIAMETER REQUIRE DEBRIS CAGE SEE HDPE DEBRIS CAGE DETIAL ON THIS SHEET.



HDPE ORIFICE END PLATE DETAIL

NOT TO SCALE



DETENTION POND AT TURBINE E-1

NOT TO SCALE

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
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ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13928 LICENSED PROFESSIONAL ENGINEER 12/3/13

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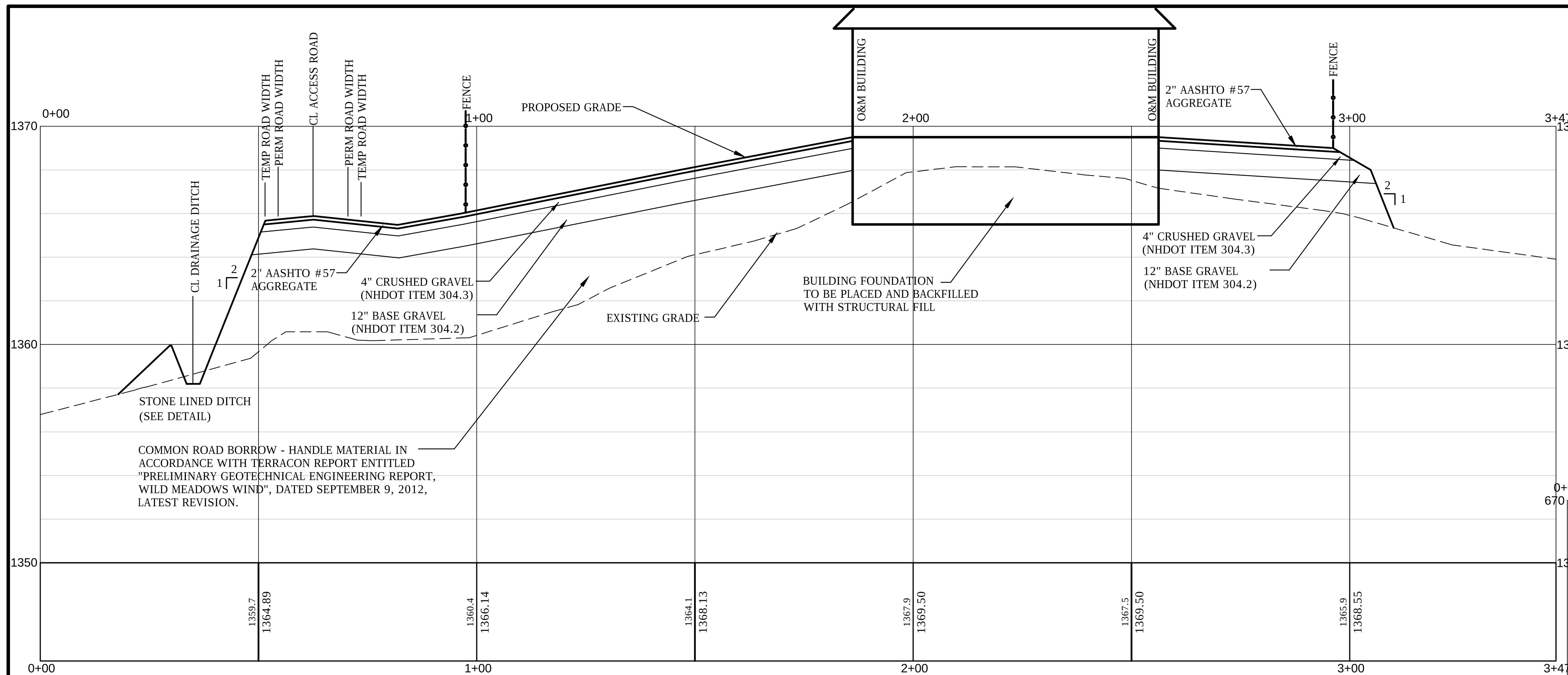
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

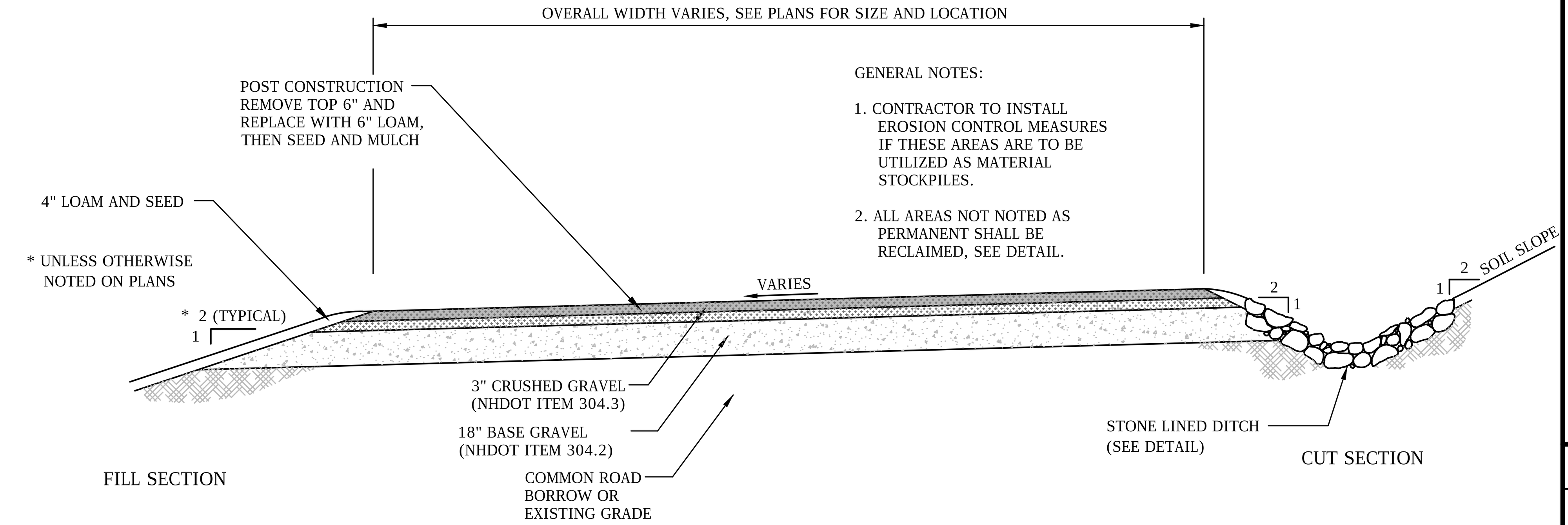
SHEET TITLE: STORM WATER PONDS SECTIONS AND DETAILS

SHEET NUMBER: D 1.4



SECTION A-A' OPERATIONS AND MAINTENANCE FACILITY

STA: 0+00 to STA: 3+47



GENERAL NOTES:

1. CONTRACTOR TO INSTALL EROSION CONTROL MEASURES IF THESE AREAS ARE TO BE UTILIZED AS MATERIAL STOCKPILES.
2. ALL AREAS NOT NOTED AS PERMANENT SHALL BE RECLAIMED, SEE DETAIL.

TYPICAL LAYDOWN / MATERIAL STOCKPILE AREA

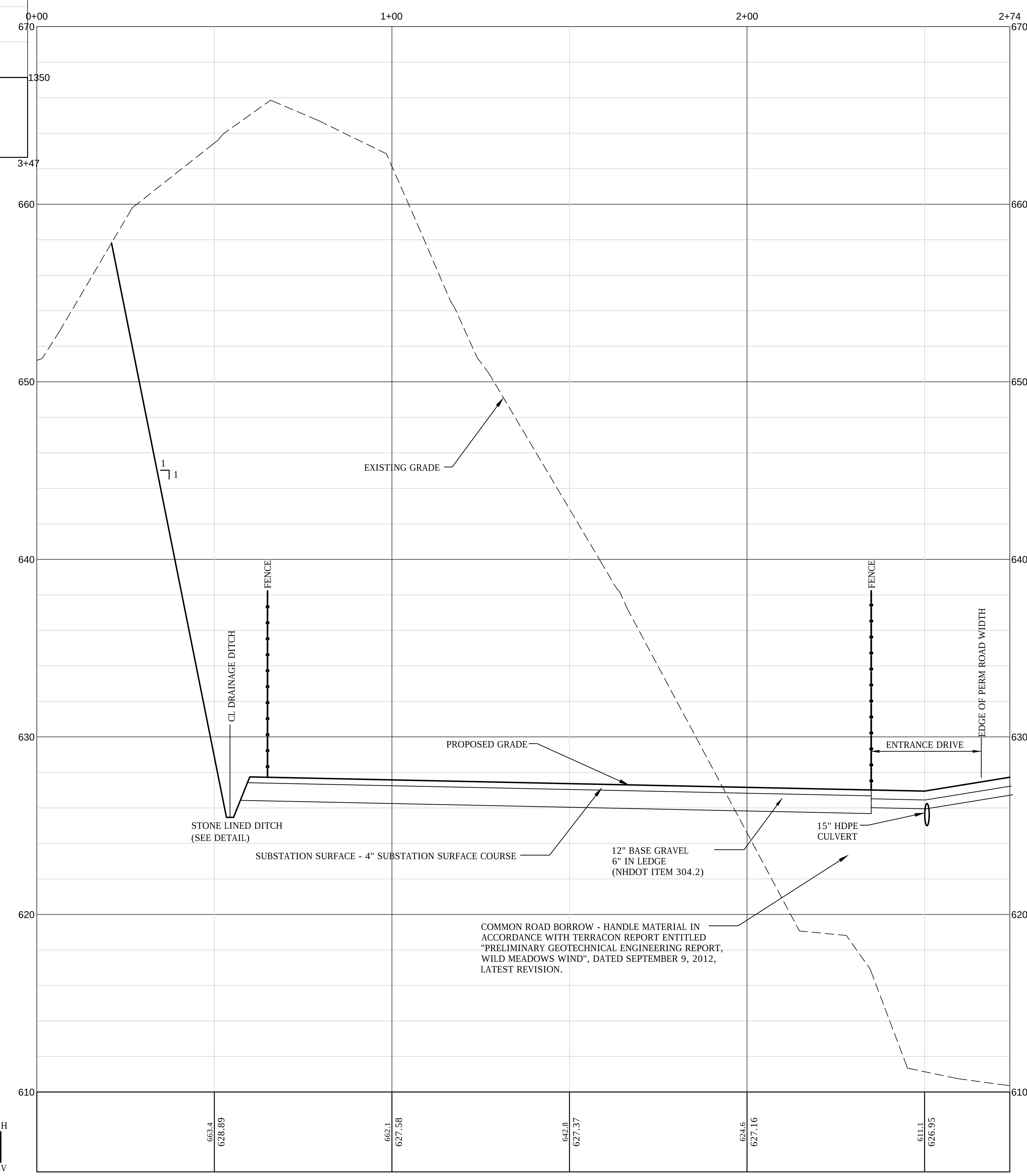
NOT TO SCALE

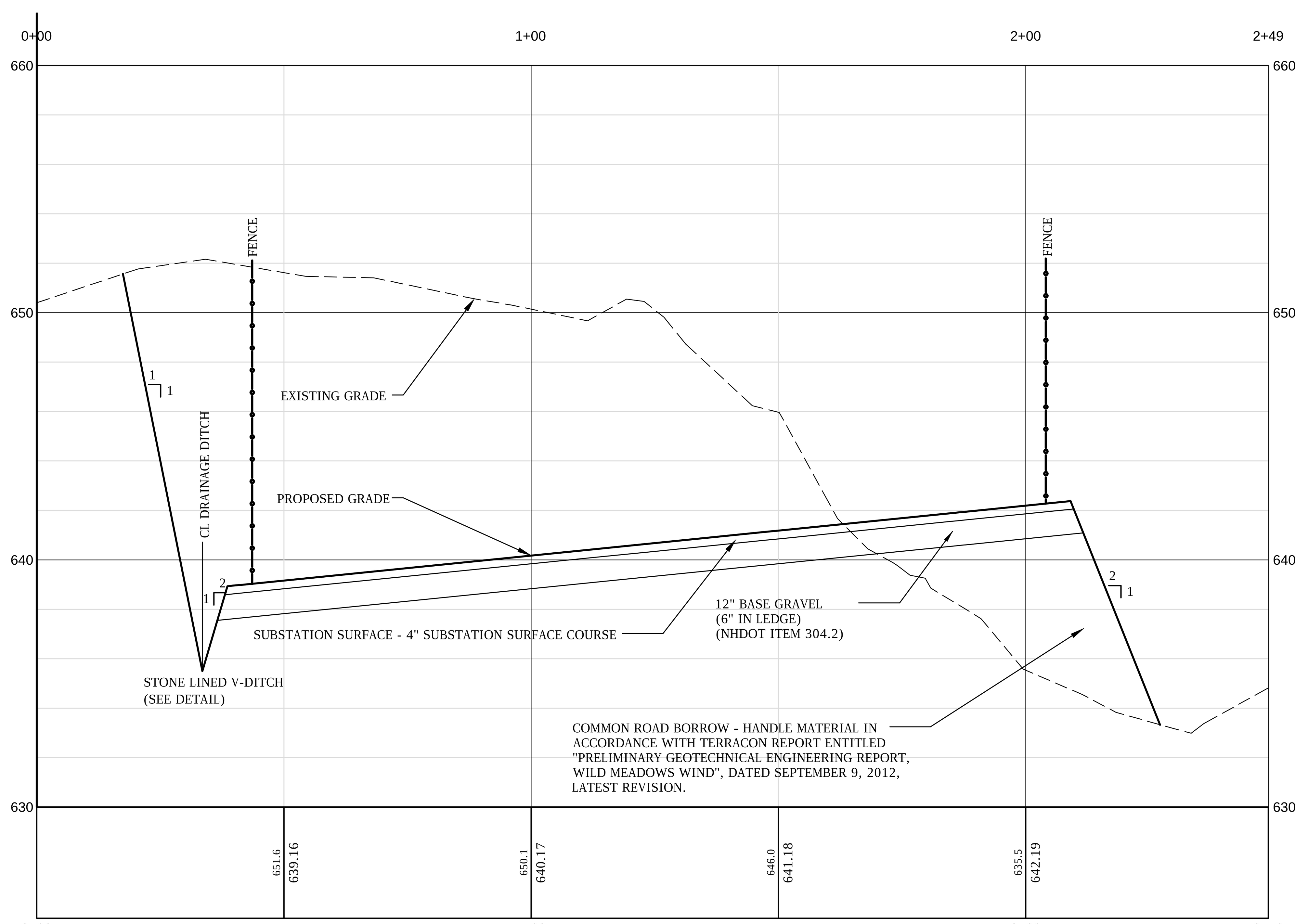
AASHTO #57 AGGREGATE

SIEVE (PERCENTAGE PASSING BY WEIGHT)

1-1/2"------------------100
1"------------------------95-100
1/2"----------------------25-60
#4-------------------------1-10
#200---------------------0-2

0 10H 20H 40H 80H
0 2V 4V 8V 16V
SCALE IN FEET





SECTION B-B' SUBSTATION

STA: 0+00 to STA: 2+49

0 10H 20H 40H 80H
0 2V 4V 8V 16V
SCALE IN FEET

SECTION C-C' INTERCONNECTION STATION

STA: 0+00 to STA: 2+74

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IBERDROLA RENEWABLES

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STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 PROFESSIONAL ENGINEER 12/3/13

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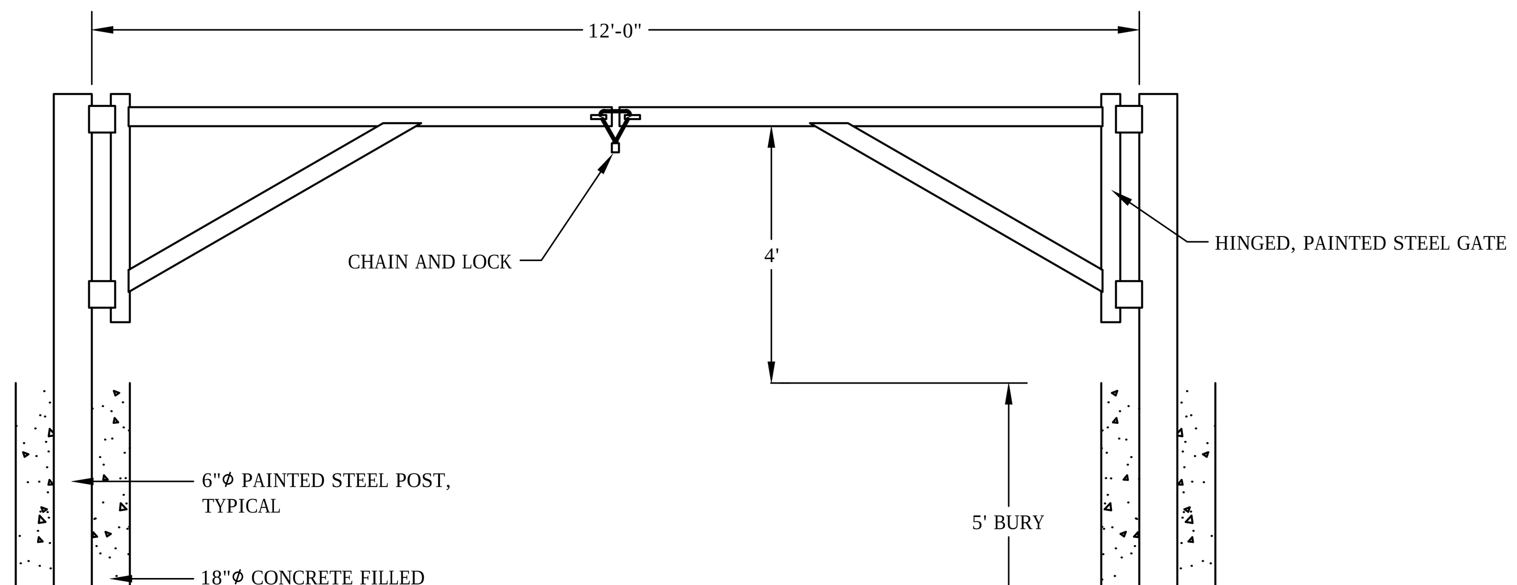
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

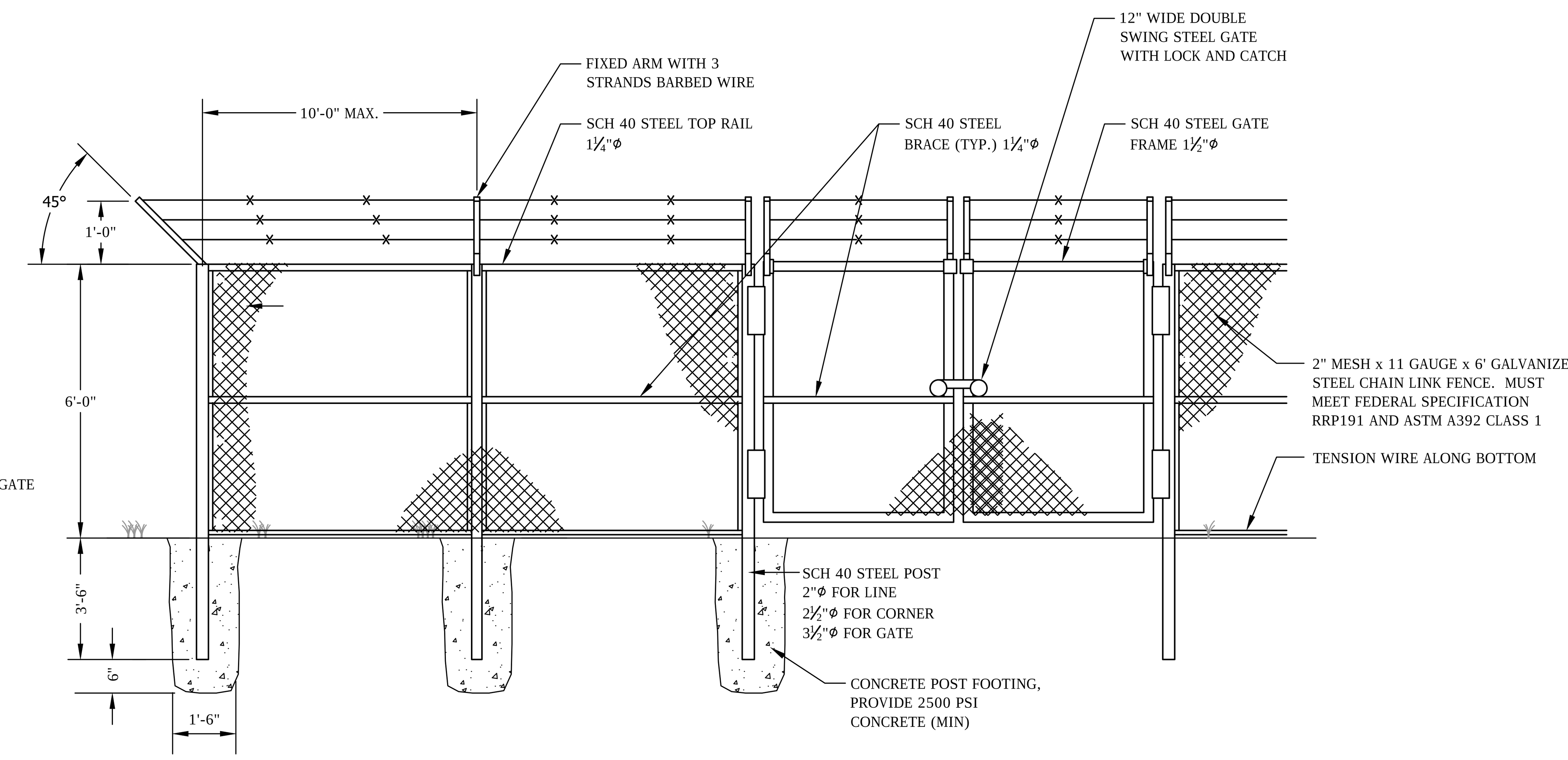
SHEET TITLE: SITE DETAILS

SHEET NUMBER: D 1.5



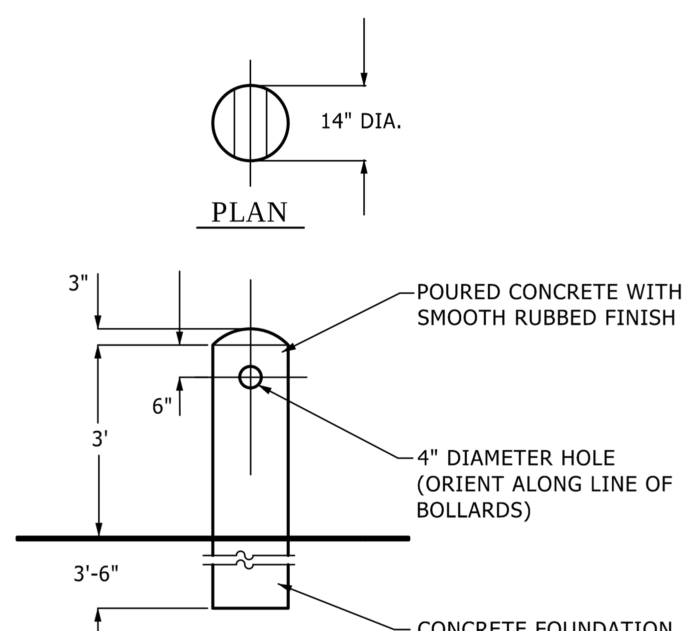
GATE DETAIL

NOT TO SCALE



CHAIN LINK FENCE DETAIL

NOT TO SCALE



CONCRETE BOLLARD DETAIL

NOT TO SCALE

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IBERDROLA RENEWABLES

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STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 LICENSED PROFESSIONAL ENGINEER 11/21/13

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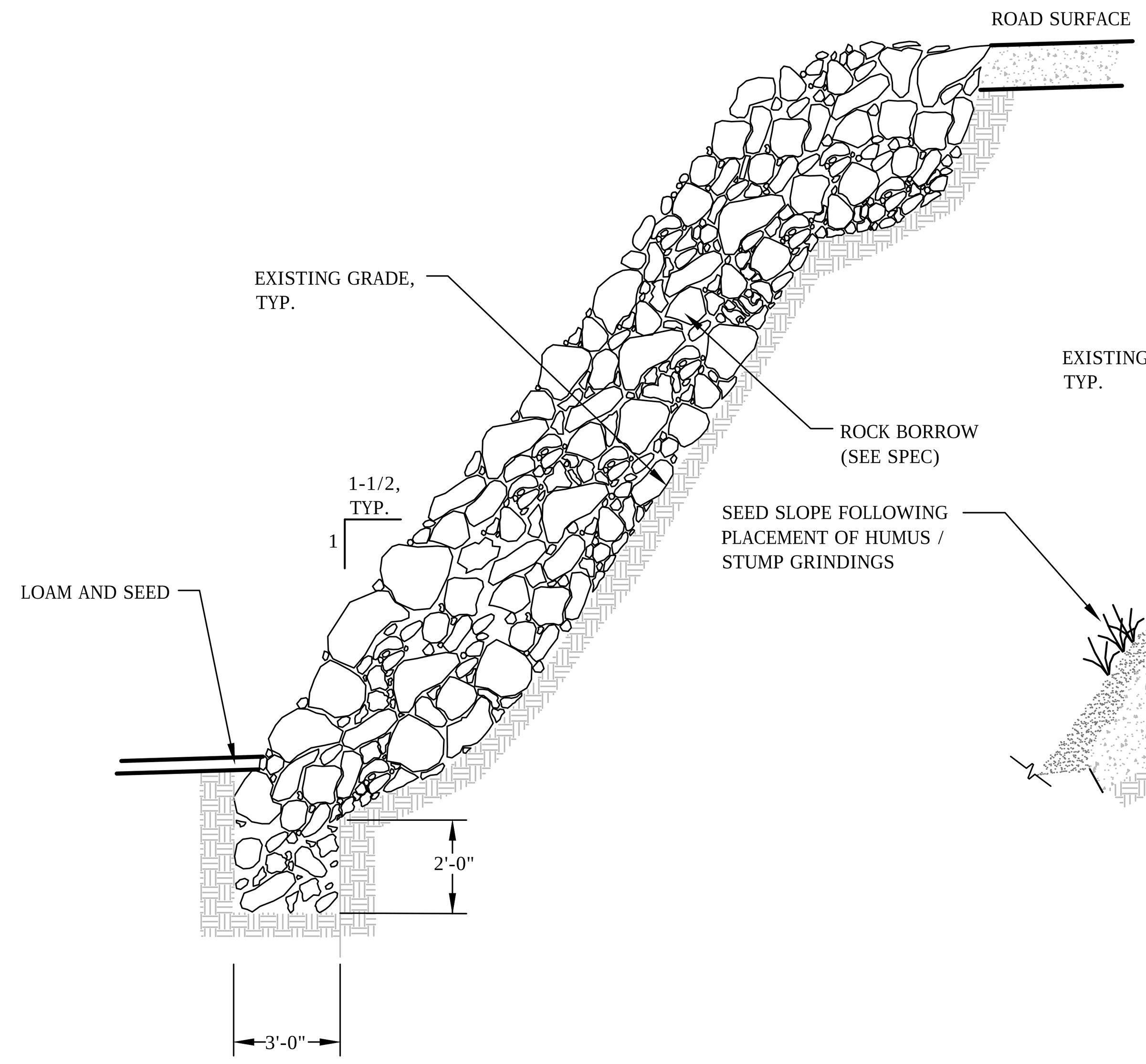
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

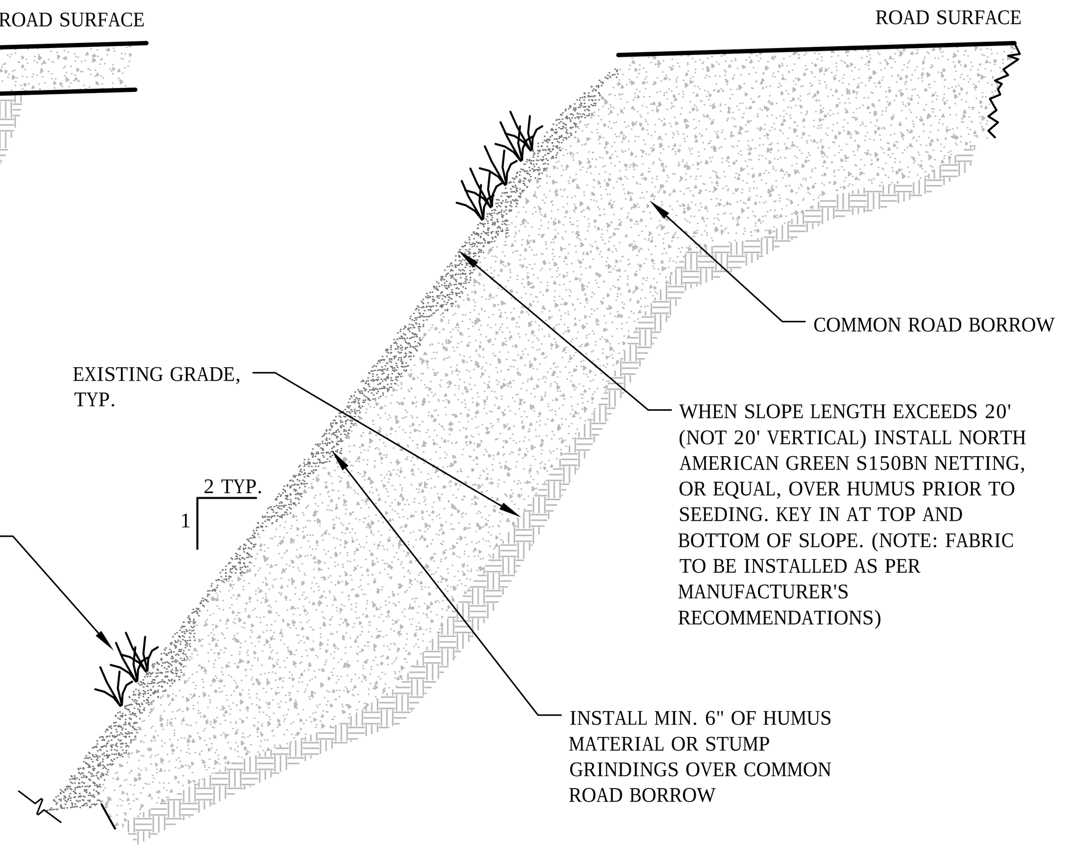
SHEET TITLE: SITE DETAILS

SHEET NUMBER: D 1.6



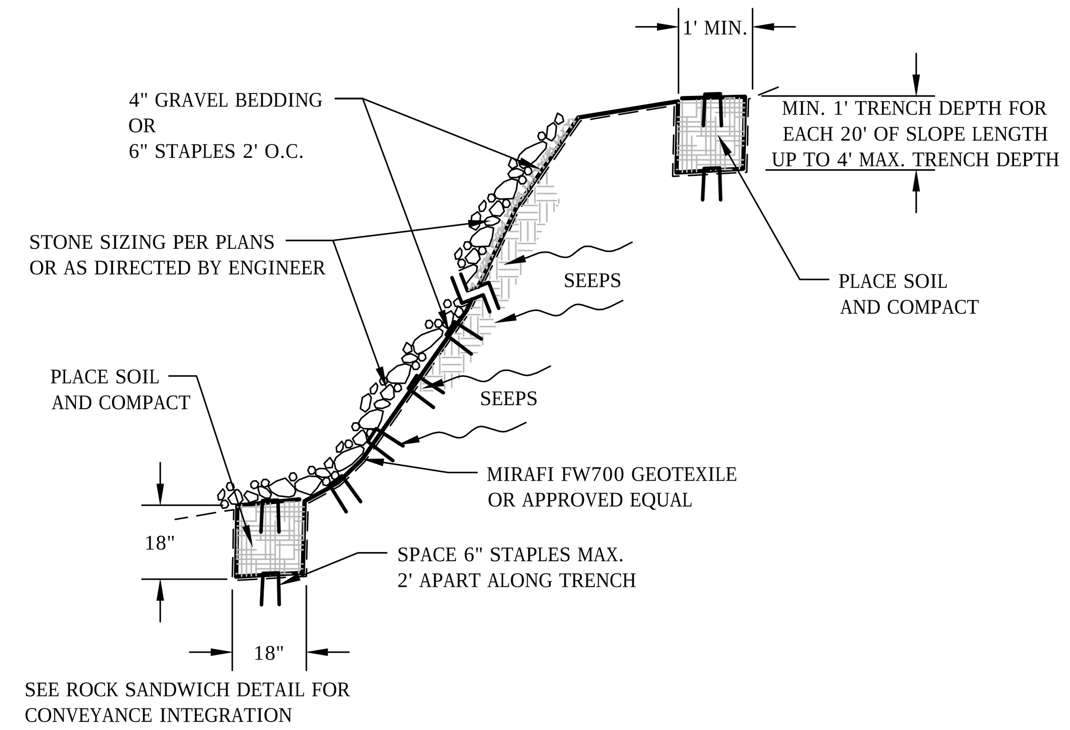
ROCK BORROW SLOPE DETAIL

NOT TO SCALE



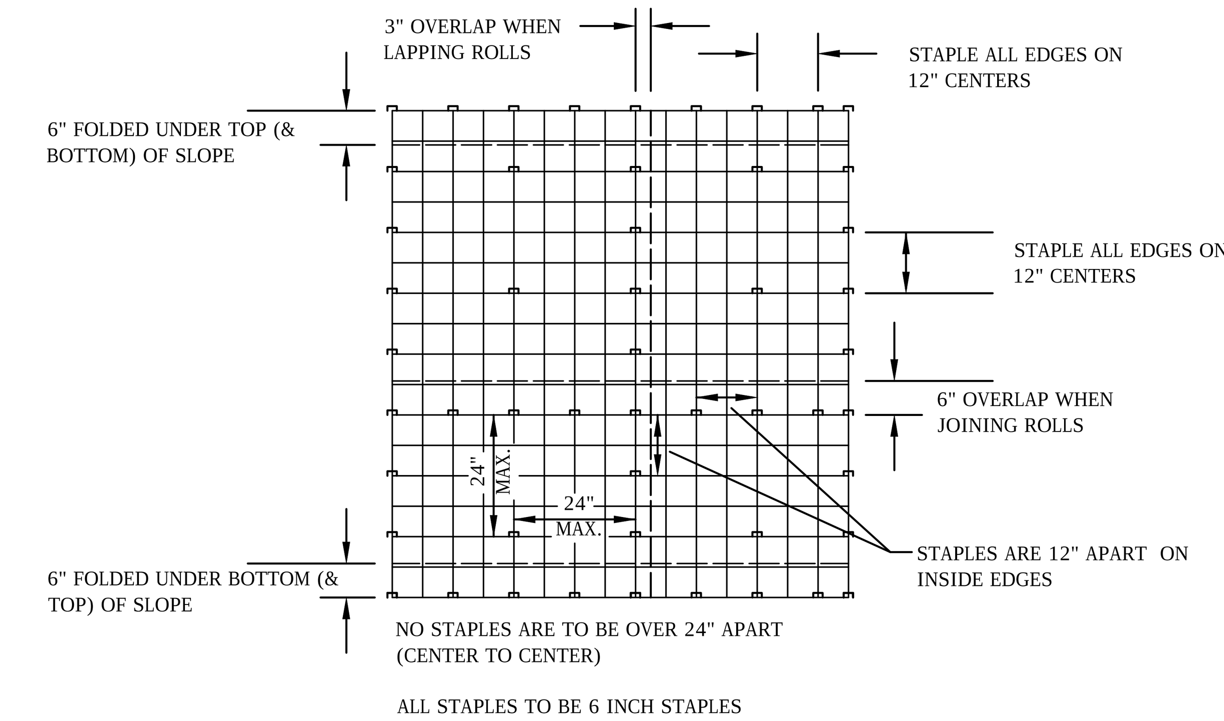
VEGETATED SLOPE DETAIL

NOT TO SCALE



GROUND WATER SEEP SLOPE DETAIL

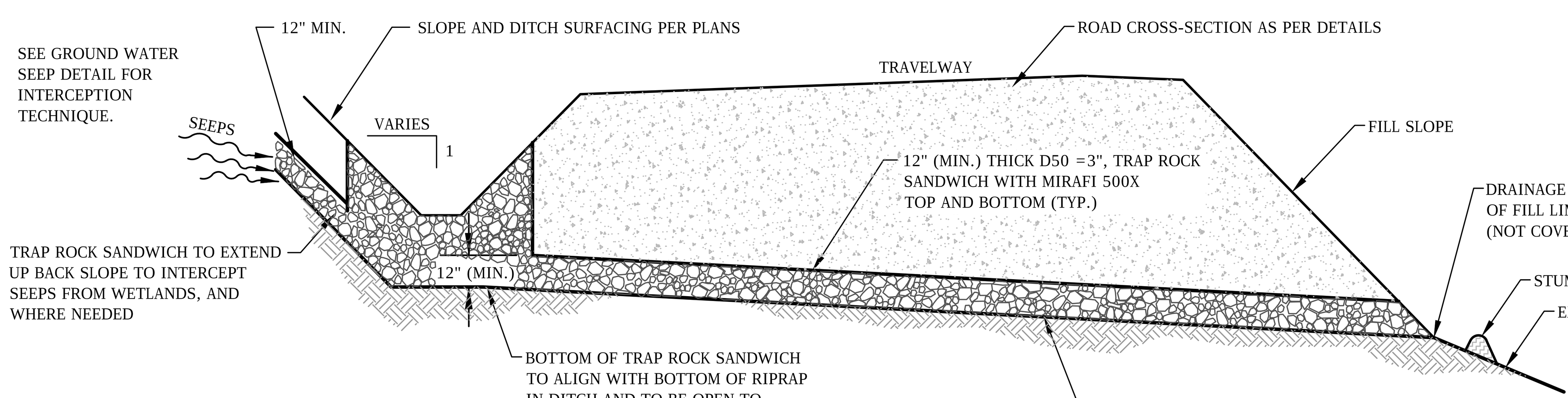
NOT TO SCALE



MULCH NETTING DETAIL

NO SCALE

SOURCE: USDA SOIL CONSERVATION SERVICE

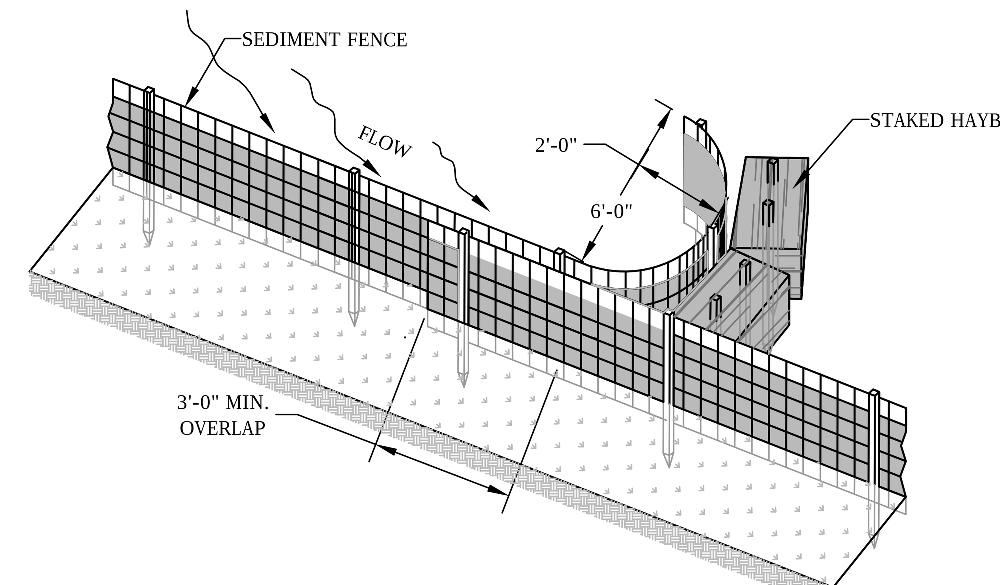


NOTE:

ROCK SANDWICH CROSS DRAINAGE TO BE USED IN ALL AREAS WHERE ROADS ARE CONSTRUCTED THROUGH WETLANDS EXCLUDING STREAM CHANNELS AND WETLANDS CROSSED WITH CULVERTS. ADDITIONAL AREAS REQUIRING THE ROCK SANDWICH MAY BE ENCOUNTERED ONCE CONSTRUCTION COMMENCES AND WILL BE DETERMINED BY THE FIELD ENGINEER. ROCK SANDWICHED SHALL BE 10 FEET WIDE (THROUGHOUT PROJECT)

ROCK SANDWICH DETAIL

NOT TO SCALE

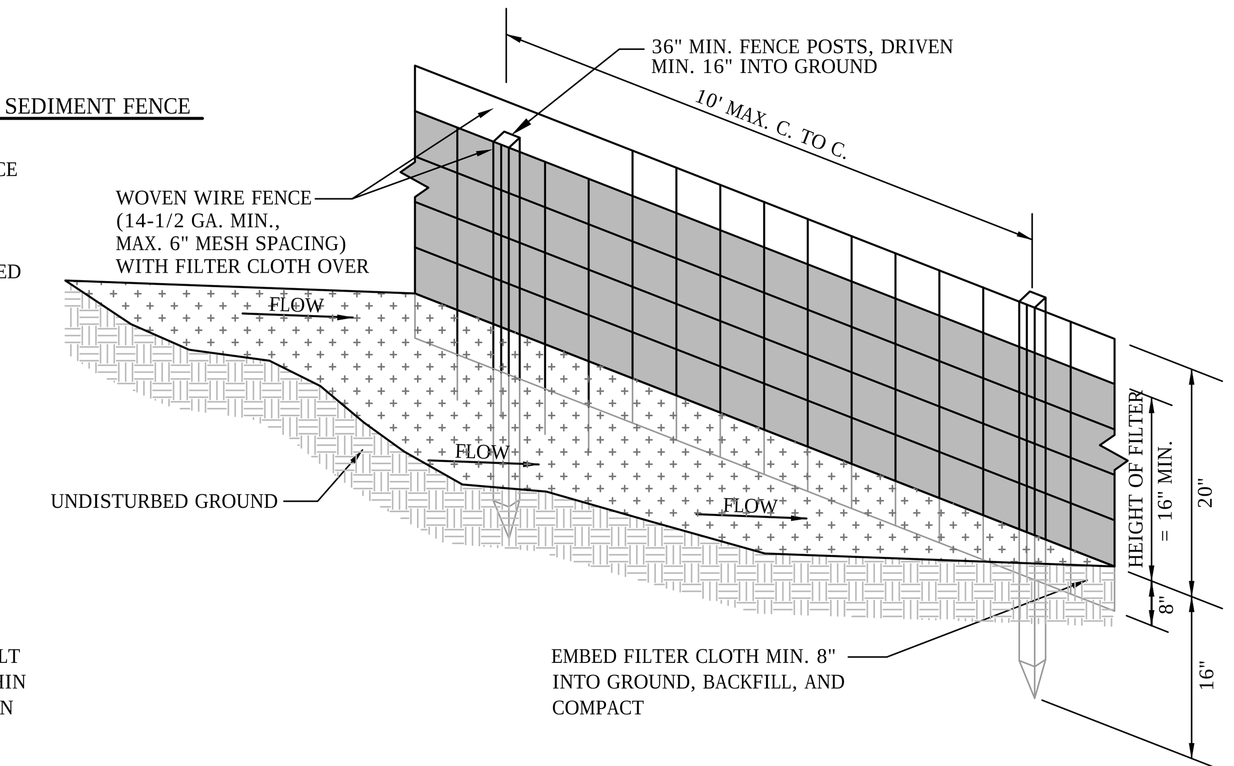


SEDIMENT FENCE POCKET

NO SCALE

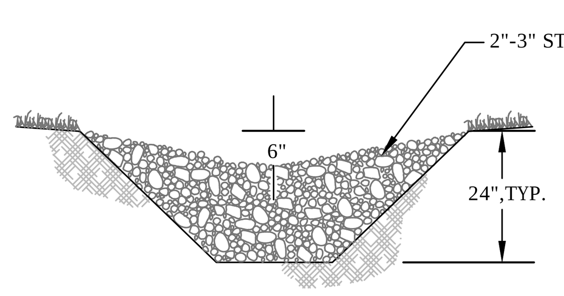
CONSTRUCTION NOTES FOR SEDIMENT FENCE

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP, MID SECTION, AND BOTTOM.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER, THEY SHALL BE OVERLAPPED BY 6 INCHES, FOLDED AND STAPLED.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE, OR MATERIAL IS WITHIN 8" FROM TOP OF ANY PORTION OF THE FILTER CLOTH.
5. A STUMP GRINDING BERM OF EQUIVALENT HEIGHT AND 3' - 4' WIDE AT ITS BASE WILL BE CONSIDERED AN EQUIVALENT ALTERNATIVE TO SEDIMENT FENCE

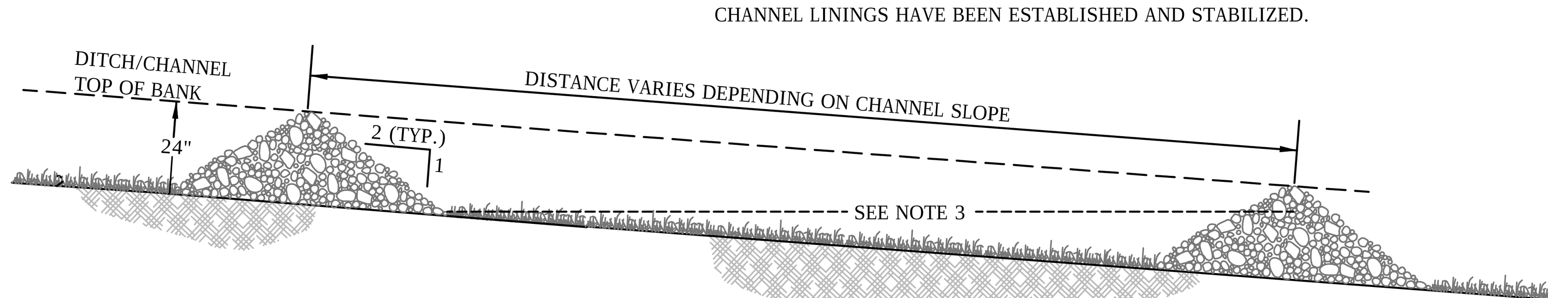


SEDIMENT FENCE (SF)

NO SCALE



SECTION VIEW



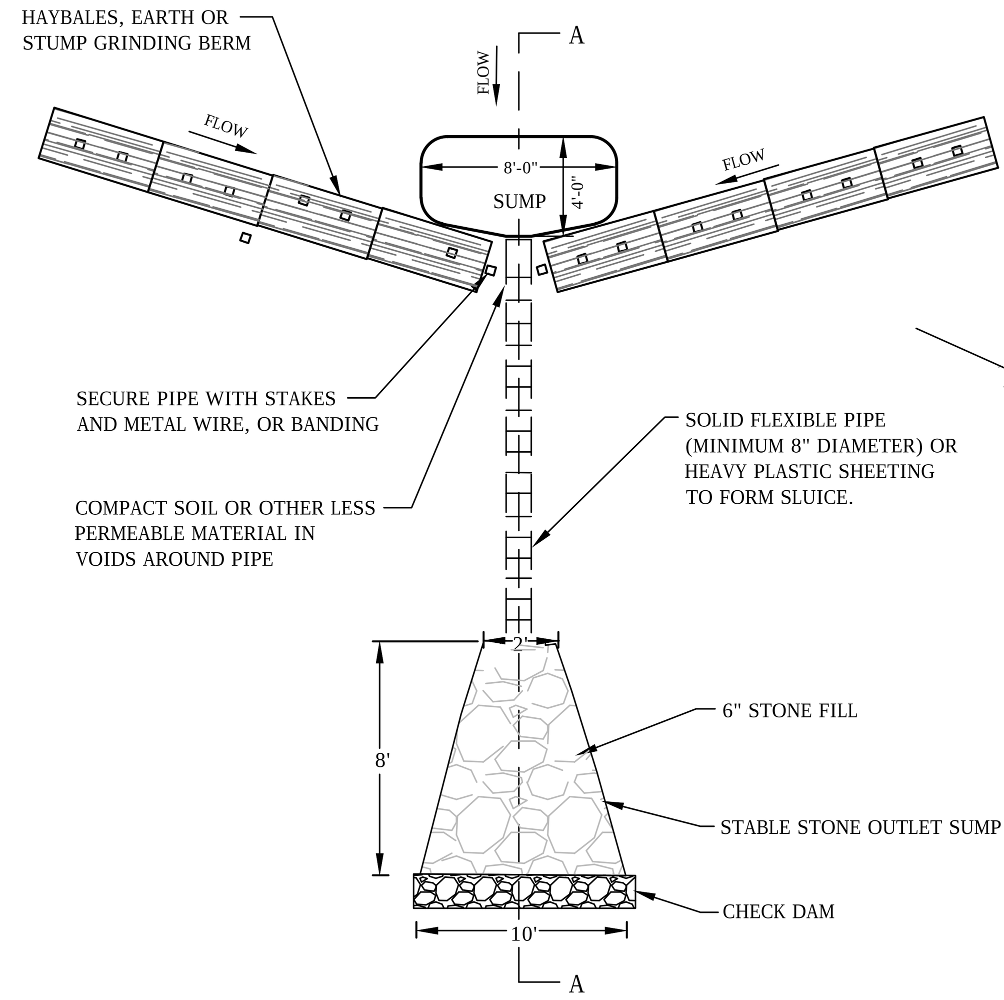
PROFILE VIEW

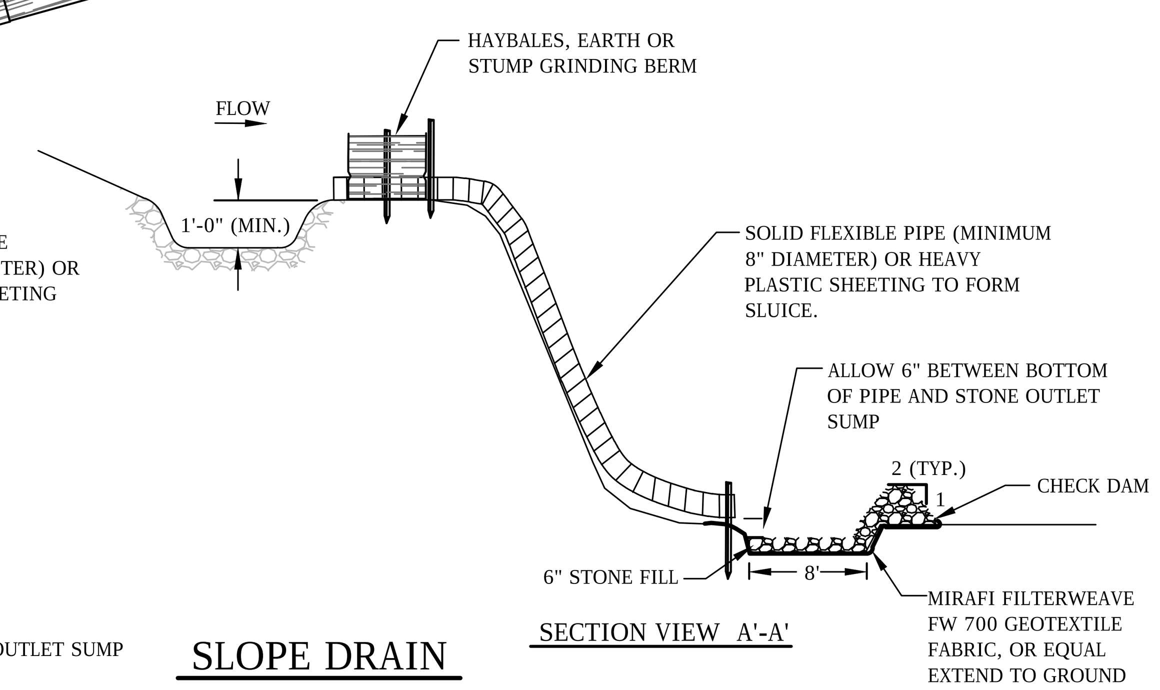
NOTES

1. CONSTRUCT STONE CHECK DAMS IN AREAS OF CONCENTRATED FLOW OR AS NECESSARY.
2. CONSTRUCT SPILLWAY IN CENTER OF STONE CHECK DAM 6" BELOW TOP OF CHANNEL.
3. THE MAXIMUM SPACING BETWEEN THE STRUCTURES SHOULD BE SUCH THAT THE TOE OF THE UPSTREAM STRUCTURE IS AT THE SAME ELEVATION AS THE SPILLWAY ELEVATION OF THE DOWNSTREAM STRUCTURE, THIS WILL VARY DEPENDING ON THE SLOPE OF THE CHANNEL.
4. STONE CHECK DAMS SHALL CONSIST OF A WELL GRADED MIXTURE OF 2" - 3" STONE.
5. REMOVE STONE CHECK DAMS AND ANY ACCUMULATED SILT IN CHANNEL ONCE PERMANENT CHANNEL LININGS HAVE BEEN ESTABLISHED AND STABILIZED.

STONE CHECK DAM DETAIL

NOT TO SCALE

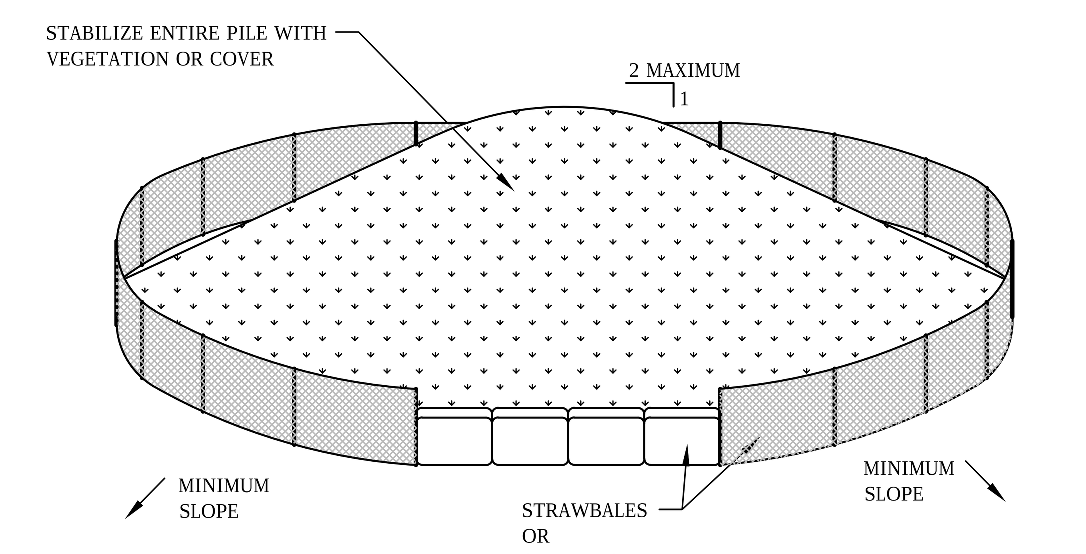




SLOPE DRAIN

NOT TO SCALE

SECTION VIEW A'-A'



SOIL STOCKPILING IS TO BE USED WHERE TOPSOIL IS NECESSARY FOR REGRADING AND VEGETATING DISTURBED AREAS.

TEMPORARY STOCKPILE STABILIZATION MEASURES INCLUDE VEGETATIVE COVERS, MULCH, NON-VEGETATIVE COVERS, AND PERIPHERAL SEDIMENT TRAPPING BARRIERS. THE STABILIZATION MEASURE(S) SELECTED SHOULD BE APPROPRIATE FOR THE TIME OF YEAR, SITE CONDITIONS, AND REQUIRED PERIOD OF USE.

INSTALLATION NOTES:

1. AREA CHOSEN FOR STOCKPILING OPERATIONS SHALL BE DRY AND STABLE.
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2:1.
3. EACH PILE SHALL BE SURROUNDED WITH EITHER SILT FENCING OR HAYBALES AND THEN STABILIZED WITH VEGETATION OR COVERED WITHIN 14 DAYS OF WHEN SOIL IS PLACED.

SOIL STOCKPILING DETAIL

NOT TO SCALE

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IBERDROLA RENEWABLES

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DATE: NOVEMBER 2013
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horizons Engineering INC
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: EROSION CONTROL DETAILS

SHEET NUMBER: D 2.1

EROSION CONTROL GENERAL NOTES

A. KEEP SITE MODIFICATION TO A MINIMUM

1. EXPOSE AREAS OF BARE SOIL TO EROSIVE ELEMENTS FOR THE SHORTEST TIME POSSIBLE.
2. SAVE AND PROTECT DESIRABLE EXISTING VEGETATION WHERE POSSIBLE. ERECT BARRIERS TO PREVENT DAMAGE FROM CONSTRUCTION EQUIPMENT.
3. LIMIT THE GRADES OF SLOPES SO VEGETATION CAN BE EASILY ESTABLISHED AND MAINTAINED.
4. AVOID SUBSTANTIAL INCREASE IN RUNOFF LEAVING THE SITE.

B. MINIMIZE POLLUTION OF WATER DURING CONSTRUCTION ACTIVITIES

1. STOCKPILE HUMUS REMOVED FROM CONSTRUCTION AREA AND SPREAD OVER ANY DISTURBED AREAS PRIOR TO REVEGETATION. TOPSOIL STOCKPILES MUST BE PROTECTED FROM EROSION.
2. PROTECT BARE SOIL AREAS EXPOSED BY GRADING ACTIVITIES WITH TEMPORARY VEGETATION OR MULCHES.
3. USE SEDIMENT TRAPS TO TRAP DEBRIS AND SEDIMENT WHICH WILL PREVENT THESE MATERIALS FROM MOVING OFF SITE.
4. WHERE EARTH DISTURBANCE OCCURS WITHIN 50 FEET OF WETLANDS OR STREAMS REDUNDANT SEDIMENT CONTROLS MAY BE NECESSARY. SEE SWPPP.
5. USE DIVERSIONS TO DIRECT WATER AROUND THE CONSTRUCTION AREA AND AWAY FROM EROSION PRONE AREAS TO POINTS OF SAFE DISPOSAL.
6. USE TEMPORARY CULVERTS OR BRIDGES WHEN CROSSING STREAMS OR FLOWING OR PONDED WATER WITHIN WETLANDS WITH EQUIPMENT.
7. PLACE CONSTRUCTION FACILITIES, MATERIALS, AND EQUIPMENT STORAGE AND MAINTENANCE AREAS AWAY FROM DRAINAGE WAYS.

C. PROTECT AREA AFTER CONSTRUCTION.

1. ESTABLISH GRASS OR OTHER SUITABLE VEGETATION ON ALL DISTURBED AREAS. SELECT SPECIES ADAPTED TO THE SITE CONDITIONS AND THE FUTURE USE OF THE AREA. FINAL GRADES SHALL BE SEEDED WITHIN 72 HOURS OF ACHIEVING FINISH GRADES, OR IF SURFACE WILL NOT BE RE-DISTURBED WITHIN 14 DAYS. IF THE END OF THE 72 HOUR PERIOD FALLS ON A WEEKEND, SUCH SURFACES WILL BE SEEDED DURING THE NEXT WORKING DAY. THE PROJECT SHALL BE MANAGED IN A MANNER THAT MEETS THE REQUIREMENTS AND INTENT OF RSA 430:43 AND CHAPTER AGR 3800 RELATIVE TO INVASIVE SPECIES.
2. MAINTAIN VEGETATED AREAS USING PROPER VEGETATIVE 'BEST MANAGEMENT PRACTICES' DURING THE CONSTRUCTION PERIOD.
3. MAINTAIN NEEDED STRUCTURAL 'BEST MANAGEMENT PRACTICES' AND REMOVE SEDIMENT FROM DETENTION PONDS AND SEDIMENT BASINS AS NEEDED.
4. DETERMINE RESPONSIBILITY FOR LONG TERM MAINTENANCE OF PERMANENT 'BEST MANAGEMENT PRACTICES'.

EROSION CONTROL MONITORING NOTES

1. A CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL OR A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF NEW HAMPSHIRE ("MONITOR") SHALL BE EMPLOYED TO INSPECT THE SITE FROM THE START OF ALTERATION OF TERRAIN ACTIVITIES UNTIL THE SITE IS IN FULL COMPLIANCE WITH THE ALTERATION OF TERRAIN PERMIT ("PERMIT").
2. DURING THIS PERIOD, THE MONITOR SHALL INSPECT THE SUBJECT SITE AT LEAST ONCE A WEEK, AND IF POSSIBLE, DURING ANY 1/2 INCH OR GREATER RAIN EVENT (I.E. 1/2 INCH OF PRECIPITATION OR MORE WITHIN A 24 HOUR PERIOD). IF UNABLE TO BE PRESENT DURING SUCH AS STORM, THE MONITOR SHALL INSPECT THE SITE WITHIN 24 HOURS OF THIS EVENT.
3. THE MONITOR SHALL PROVIDE TECHNICAL ASSISTANCE AND RECOMMENDATIONS TO THE CONTRACTOR ON THE APPROPRIATE BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROLS REQUIRED TO MEET THE REQUIREMENTS OF RSA 485-A:17 AND ALL APPLICABLE DES PERMIT CONDITIONS.
4. WITHIN 24 HOURS OF EACH INSPECTION, THE MONITOR SHALL SUBMIT A REPORT TO DES VIA EMAIL (TO CRAIG RENNIE AT: CRAIG.RENNIE@DES.NH.GOV). REPORTS SHALL INCLUDE PHOTOGRAPHS OF THE SITE THAT ARE REPRESENTATIVE OF THE PROJECT.
5. PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR'S NAME, ADDRESS, AND PHONE NUMBER SHALL BE SUBMITTED TO DES VIA EMAIL (TO CRAIG RENNIE AT: CRAIG.RENNIE@DES.NH.GOV).

COLD WEATHER SITE STABILIZATION REQUIREMENTS

TO ADEQUATELY PROTECT WATER QUALITY DURING COLD WEATHER AND DURING SPRING RUNOFF, THE FOLLOWING ADDITIONAL STABILIZATION TECHNIQUES SHALL BE EMPLOYED DURING THE PERIOD FROM NOVEMBER 30 THROUGH MAY 1:

1. THE AREA OF EXPOSED, UNSTABILIZED SOIL SHALL BE LIMITED TO ONE ACRE AND SHALL BE PROTECTED AGAINST EROSION BY THE METHODS DESCRIBED IN THIS SECTION PRIOR TO ANY THAW OR SPRING MELT EVENT. THE ALLOWABLE AREA OF EXPOSED SOIL MAY BE INCREASED IF A WINTER CONSTRUCTION PLAN, DEVELOPED BY A QUALIFIED ENGINEER OR A CPESC SPECIALIST, IS REVIEWED AND APPROVED BY NHDES.
2. ALL PROPOSED VEGETATED AREAS HAVING A SLOPE OF LESS THAN 15% WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY NOVEMBER 30, OR WHICH ARE DISTURBED AFTER NOVEMBER 30, SHALL BE SEEDED AND COVERED WITH 3 TO 4 TONS OF HAY OR STRAW MULCH PER ACRE SECURED WITH ANCHORED NETTING OR TACKIFIER, OR 2 INCHES STUMP GRINDINGS.
3. ALL PROPOSED VEGETATED AREAS HAVING A SLOPE OF GREATER THAN 15% WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY NOVEMBER 30, OR WHICH ARE DISTURBED AFTER NOVEMBER 30, SHALL BE SEEDED AND COVERED WITH A PROPERLY INSTALLED AND ANCHORED EROSION CONTROL BLANKET OR WITH A MINIMUM 4 INCH THICKNESS OF STUMP GRINDINGS.
4. INSTALLATION OF ANCHORED HAY MULCH OR STUMP GRINDINGS, SHALL NOT OCCUR OVER SNOW OF GREATER THAN ONE INCH IN DEPTH OR THREE (3) INCHES IN DEPTH, RESPECTIVELY.
5. INSTALLATION OF EROSION CONTROL BLANKETS SHALL NOT OCCUR OVER SNOW OF GREATER THAN ONE INCH IN DEPTH OR ON FROZEN GROUND.
6. ALL PROPOSED STABILIZATION IN ACCORDANCE WITH NOTES 2 OR 3 ABOVE, SHALL BE COMPLETED WITHIN A DAY OF ESTABLISHING THE GRADE THAT IS FINAL OR THAT OTHERWISE WILL EXIST FOR MORE THAN 5 DAYS.
7. ALL DITCHES OR SWALES WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY NOVEMBER 30, OR WHICH ARE DISTURBED AFTER NOVEMBER 30, SHALL BE STABILIZED TEMPORARILY WITH STONE OR EROSION CONTROL BLANKETS APPROPRIATE FOR THE DESIGN FLOW CONDITIONS, AS DETERMINED BY THE OWNER'S ENGINEERING CONSULTANT.
8. AFTER NOVEMBER 30, INCOMPLETE ROAD OR PARKING AREAS WHERE ACTIVE CONSTRUCTION OF THE ROAD OR PARKING AREA HAS STOPPED FOR THE WINTER SEASON SHALL BE PROTECTED WITH A MINIMUM 3 INCH LAYER OF BASE COURSE GRAVELS MEETING THE GRADATION REQUIREMENTS OF NHDOT STANDARD SPECIFICATION FOR ROAD AND BRIDGE CONSTRUCTION, 2006, ITEM NO. 304.1 OR 304.2.

CONSTRUCTION SEQUENCE

1. PREPARE AN EROSION CONTROL PLAN OR A STORMWATER POLLUTION PREVENTION PLAN (SWPPP), AND A USEPA NOTICE OF INTENT FORM, IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS.
2. INSTALL CONSTRUCTION ENTRANCE/EXIT, SEE DETAIL.
3. CUT AND CLEAR TREES WITHIN THE CLEARING LIMITS.
4. INSTALL SILT FENCES, ROCK CHECK DAMS, AND OTHER APPROPRIATE EROSIONS CONTROL MEASURES AT LOCATIONS SHOWN ON THE PLANS AND AS NEEDED. USE TEMPORARY CULVERTS OR BRIDGES WHEN CROSSING STREAMS OR FLOWING OR PONDED WATER WITHIN WETLANDS WITH EQUIPMENT.
5. GRUB SITE WITHIN GRADING LIMITS.
6. STRIP AND STOCKPILE HUMUS AND INSTALL OR ADJUST EROSION CONTROL MEASURES.
7. INSTALL SILT FENCE, CHECK DAMS, HAYBALES, AND SEDIMENT TRAPS AS REQUIRED.
8. CONSTRUCT PERMANENT STORMWATER CONTROLS AS SOON AS PRACTICAL. DO NOT DIRECT STORMWATER TOWARD TREATMENT SWALES, DITCHES AND LEVEL SPREADERS UNTIL THEY HAVE BEEN STABILIZED.
9. PROCEED WITH WORK, LIMITING THE DURATION OF DISTURBANCE. THE MAXIMUM WORK UNIT AREA SHALL BE THIRTY ACRES IN SIZE. THE MAXIMUM LENGTH OF TIME FROM INITIAL DISTURBANCE THAT A WORK UNIT MAY BE LEFT UNSTABILIZED IS 45 DAYS.
10. BEGIN SEEDING AND MULCHING IMMEDIATELY AFTER GRADING. ALL DISTURBED AREAS SHALL BE STABILIZED WITH APPROVED METHODS WITHIN 72 HOURS OF ACHIEVING FINISHED GRADE, OR IF SURFACE WILL NOT BE RE-DISTURBED WITHIN 14 DAYS. IF THE END OF THE 72 HOUR PERIOD FALLS ON A WEEKEND, SUCH SURFACES WILL BE SEEDED DURING THE NEXT WORKING DAY.

    AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURRED:
    A) BASE COURSE GRAVELS HAVE BEEN INSTALLED IN ROADWAYS AND AREAS TO BE PAVED;
    B) A MINIMUM OF 85% VEGETATED GROWTH HAS BEEN ESTABLISHED;
    C) A MINIMUM OF 4" OF NON-EROSIVE MATERIAL SUCH AS STONE RIPRAP OR STUMP GRINDINGS HAS BEEN INSTALLED; OR
    D) EROSION CONTROL BLANKETS HAVE BEEN PROPERLY INSTALLED.
11. INSPECT EROSION CONTROL MEASURES ON A DAILY BASIS AND AFTER EVERY 0.5 INCHES OF PRECIPITATION. MAINTAIN SILT FENCE, SEDIMENT TRAPS, HAY BALES, ETC., AS NECESSARY TO PREVENT SEDIMENT OR TURBIDITY FROM ENTERING WETLANDS OR STREAMS.
12. INSTALL FINISH COURSE GRAVEL ON ROADWAYS AND/OR PARKING AREAS.
13. PLACE HUMUS, SEED AND MULCH ON ALL SURFACES TO BE RECLAIMED.
14. COMPLETE ALL REMAINING PERMANENT EROSION CONTROL STRUCTURES.
15. MONITOR THE SITE AND MAINTAIN STRUCTURES AS NEEDED UNTIL STABILIZATION IS ACHIEVED.

SEEDING RECOMMENDATIONS

1. GRADING AND SHAPING

A. EARTHEN SLOPES SHALL NOT BE STEEPER THAN 2:1; 3:1 SLOPES OR FLATTER ARE PREFERRED. WHERE MOWING WILL BE DONE, 3:1 SLOPES OR FLATTER ARE RECOMMENDED.

2. SEEDBED PREPARATION

A. SURFACE AND SEEPAGE WATER SHOULD BE DRAINED OR DIVERTED FROM THE SITE TO PREVENT DROWNING OR WINTER KILLING OF THE PLANTS.

B. STONES LARGER THAN 4 INCHES AND TRASH SHOULD BE REMOVED BECAUSE THEY INTERFERE WITH SEEDING AND FUTURE MAINTENANCE OF THE AREA. WHERE FEASIBLE, THE SOIL SHOULD BE TILLED TO A DEPTH OF ABOUT 4 INCHES TO PREPARE A SEEDBED AND MIX FERTILIZER AND LIME THOROUGHLY INTO THE SOIL. THE SEEDBED SHOULD BE LEFT IN A REASONABLY FIRM AND SMOOTH CONDITION. THE LAST TILLAGE OPERATION SHOULD BE PERFORMED ACROSS THE SLOPE WHEREVER PRACTICAL.

3. ESTABLISHING VEGETATION

A. LIME AND FERTILIZER SHOULD BE APPLIED PRIOR TO OR AT THE TIME OF SEEDING AND INCORPORATED INTO THE SOIL. IF NEEDED, LIME AND FERTILIZER MUST BE APPLIED AT AGRONOMIC RATES BASED ON AN EVALUATION OF SOIL TESTS. FERTILIZER SHALL NOT BE APPLIED OVER FROZEN OR SNOW COVERED GROUND AND NOT IN AREAS WITH FLOWING OR STANDING WATER.

B. SEED SHOULD BE SPREAD UNIFORMLY BY THE METHOD MOST APPROPRIATE FOR THE SITE. METHODS INCLUDE BROADCASTING, DRILLING, AND HYDROSEEDING. WHERE BROADCASTING IS USED, COVER SEED WITH .25 INCH OF SOIL OR LESS, BY CULTIPACKING OR RAKING. WHERE HYDROSEEDING IS USED, SEEDING RATES SHALL BE INCREASED BY 25%. THE USE OF TACKIFIERS IN HYDROSEEDING MIXTURES IS ENCOURAGED; GUAR GUM BASED TACIFIERS ARE PREFERRED. THE USE OF POLYMERS SHALL REQUIRE PRIOR APPROVAL BY OWNER AND MAY REQUIRE ADVANCED APPROVAL FROM NHDES.

C. SEEDING MIX

ENHANCED NHDOT SLOPE 44	POUNDS PER ACRE		ENHANCED GRAFTON COUNTY CONSERVATION SEED MIX	POUNDS PER ACRE
·ANNUAL RYE GRASS	50	OR	·ANNUAL RYE GRASS	40
·TUFTED HAIRGRASS	5		·TUFTED HAIRGRASS	5
			·RED TOP	5
·NH SLOPE 44 MIX	60		·GRAFTON COUNTY CONSERVATION SEED MIX	60
TOTAL	115		TOTAL	110

D. SUBSTITUTE WINTER RYE GRASS FOR ANNUAL RYE GRASS IN MIX WHEN SEEDING FROM EARLY SPRING TO MAY 20 OR FROM AUGUST 10 TO WINTER.

4. MULCH

A. HAY, STRAW, OR OTHER MULCH SHALL BE FREE FROM INVASIVE SPECIES, AND SHOULD BE APPLIED IMMEDIATELY AFTER SEEDING.

B. IRRESPECTIVE OF MULCH APPLICATION METHOD (BY HAND, BLOWN, OR HYDRAULICALLY) MULCH SHALL FULLY COVER SEED AND SOIL SURFACE SUCH THAT NO SOIL IS VISIBLE

C. MULCH WILL BE HELD IN PLACE USING APPROPRIATE TECHNIQUES FROM THE BEST MANAGEMENT PRACTICE FOR MULCHING.

5. MAINTENANCE TO ESTABLISH A STAND.

A. PLANTED AREAS SHOULD BE PROTECTED FROM DAMAGE BY FIRE, GRAZING, TRAFFIC, AND DENSE WEED GROWTH.

B. IN WATERWAYS, CHANNELS, OR SWALES WHERE UNIFORM FLOW CONDITIONS ARE ANTICIPATED, OCCASIONAL MOWING MAY BE NECESSARY TO CONTROL GROWTH OF WOODY VEGETATION.

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: TBP
DRAWN BY: CJH
CHECK'D BY: TBO
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No. 13828
LICENSED PROFESSIONAL ENGINEER
11/21/13

horizons Engineering Inc
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: EROSION CONTROL DETAILS

SHEET NUMBER: D 2.2

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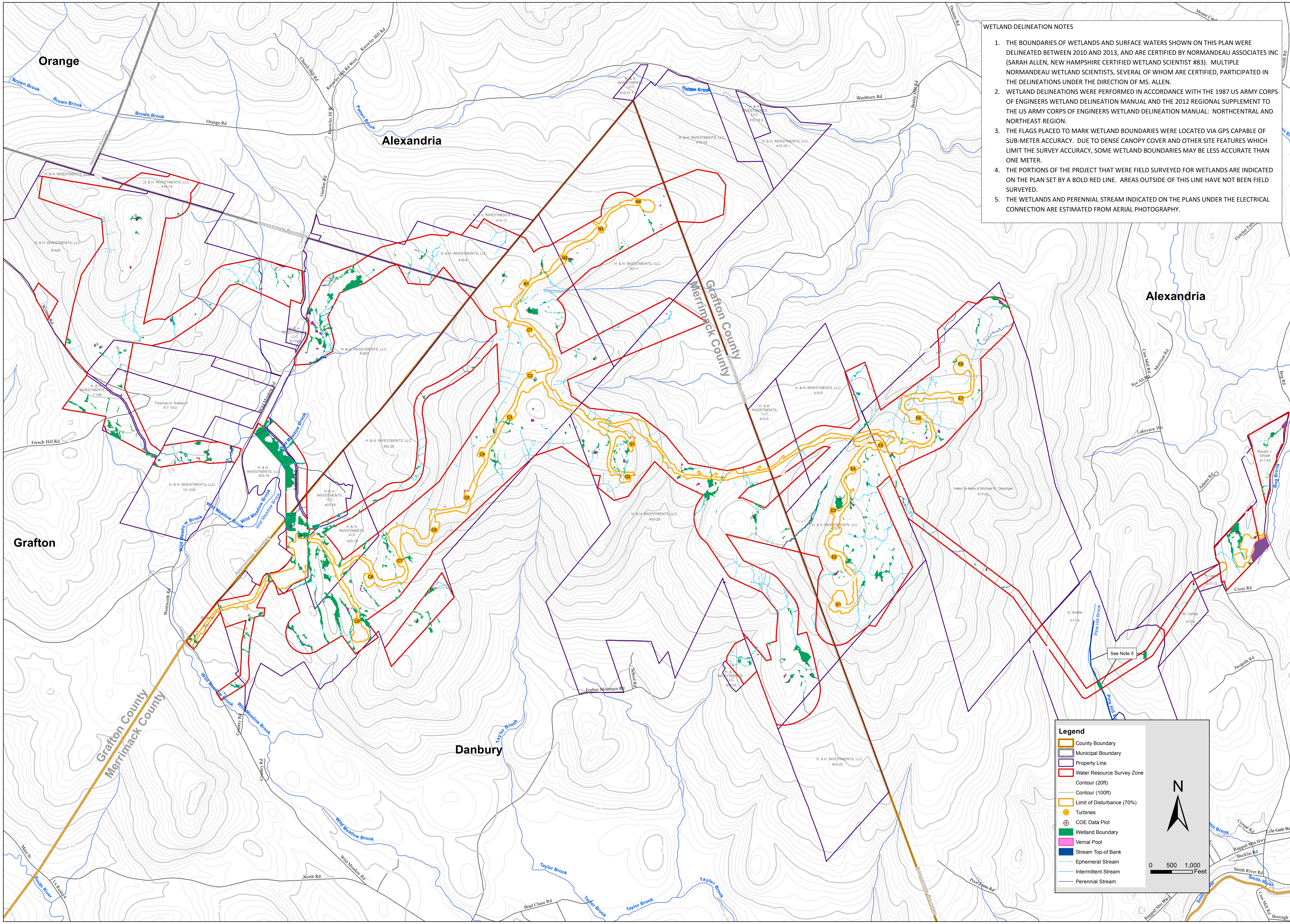
(Plans Bound Separately)

4.2 Certified Wetlands Plan



WETLAND DELINEATION NOTES

1. THE BOUNDARIES OF WETLANDS AND SURFACE WATERS SHOWN ON THIS PLAN WERE DELINEATED BETWEEN 2010 AND 2013, AND ARE CERTIFIED BY NORMANDEAU ASSOCIATES INC (SARAH ALLEN, NEW HAMPSHIRE CERTIFIED WETLAND SCIENTIST #83). MULTIPLE NORMANDEAU WETLAND SCIENTISTS, SEVERAL OF WHOM ARE CERTIFIED, PARTICIPATED IN THE DELINEATIONS UNDER THE DIRECTION OF MS. ALLEN.
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5. THE WETLANDS AND PERENNIAL STREAM INDICATED ON THE PLANS UNDER THE ELECTRICAL CONNECTION ARE ESTIMATED FROM AERIAL PHOTOGRAPHY.

Legend

- County Boundary
- Municipal Boundary
- Property Line
- Water Resource Survey Zone
- Contour (20ft)
- Contour (100ft)
- Limit of Disturbance (70%)
- Turbines
- COE Data Plot
- Wetland Boundary
- Vernal Pool
- Stream Top-of-Bank
- Ephemeral Stream
- Intermittent Stream
- Perennial Stream

N

0 500 1,000 Feet

IBERDROLA RENEWABLES

NORMANDEAU environmental consultants

NO.	DATE

DATE: 11/27/2013
PROJECT #:
ENGIN'D BY:
DRAWN BY: dpelletier
CHECK'D BY: SDA
ARCHIVE #:

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: Existing Conditions Overview

SHEET NUMBER: W 1.1

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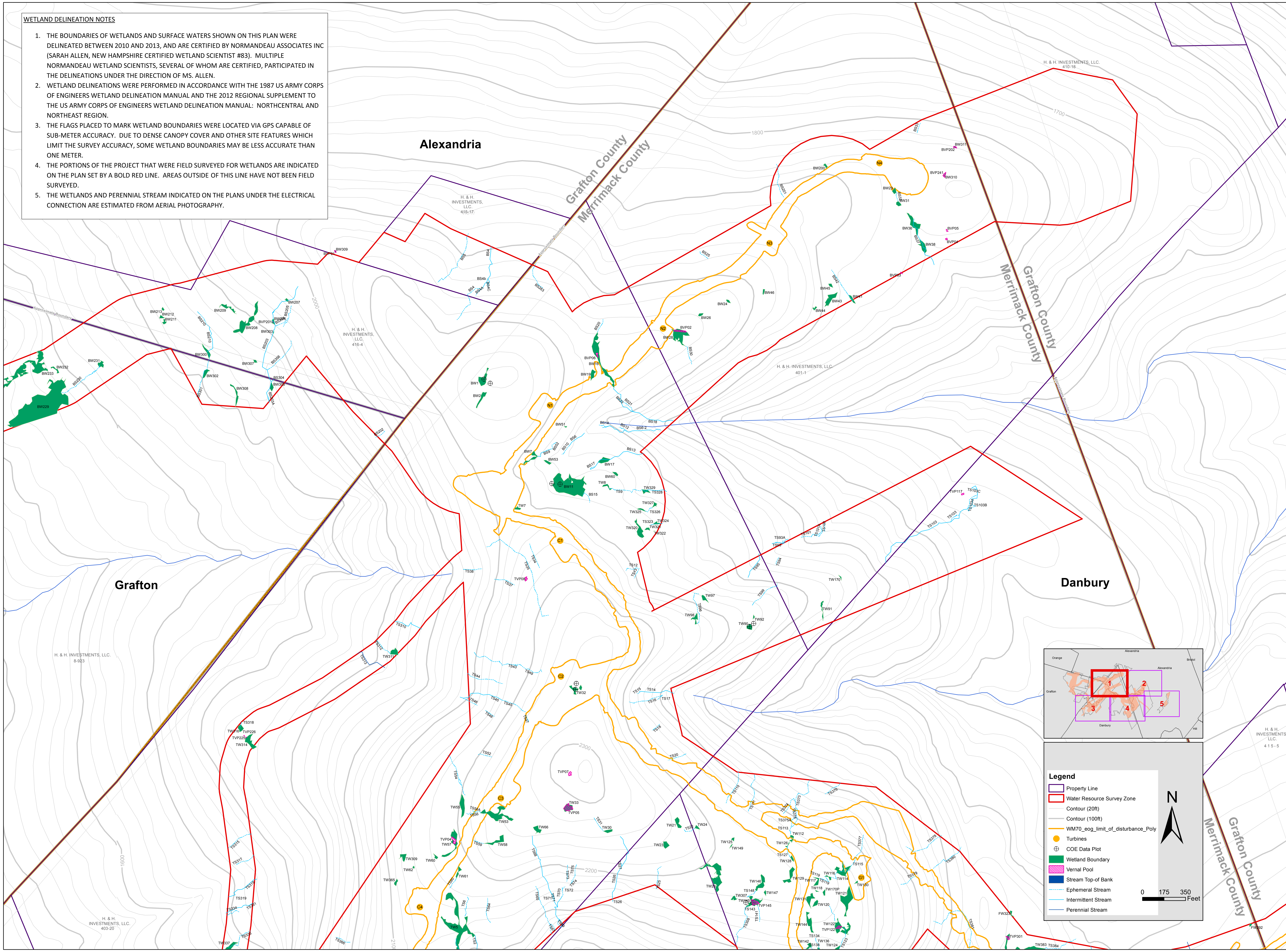

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ENGIN'D BY:
DRAWN BY: dpelletier
CHECK'D BY: SDA
ARCHIVE #:

NO. DATE

SARAH D. ALLEN No. 083 CERTIFIED WETLAND SCIENTIST

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: Existing Conditions

Tile: 1

SHEET NUMBER: W 1.2

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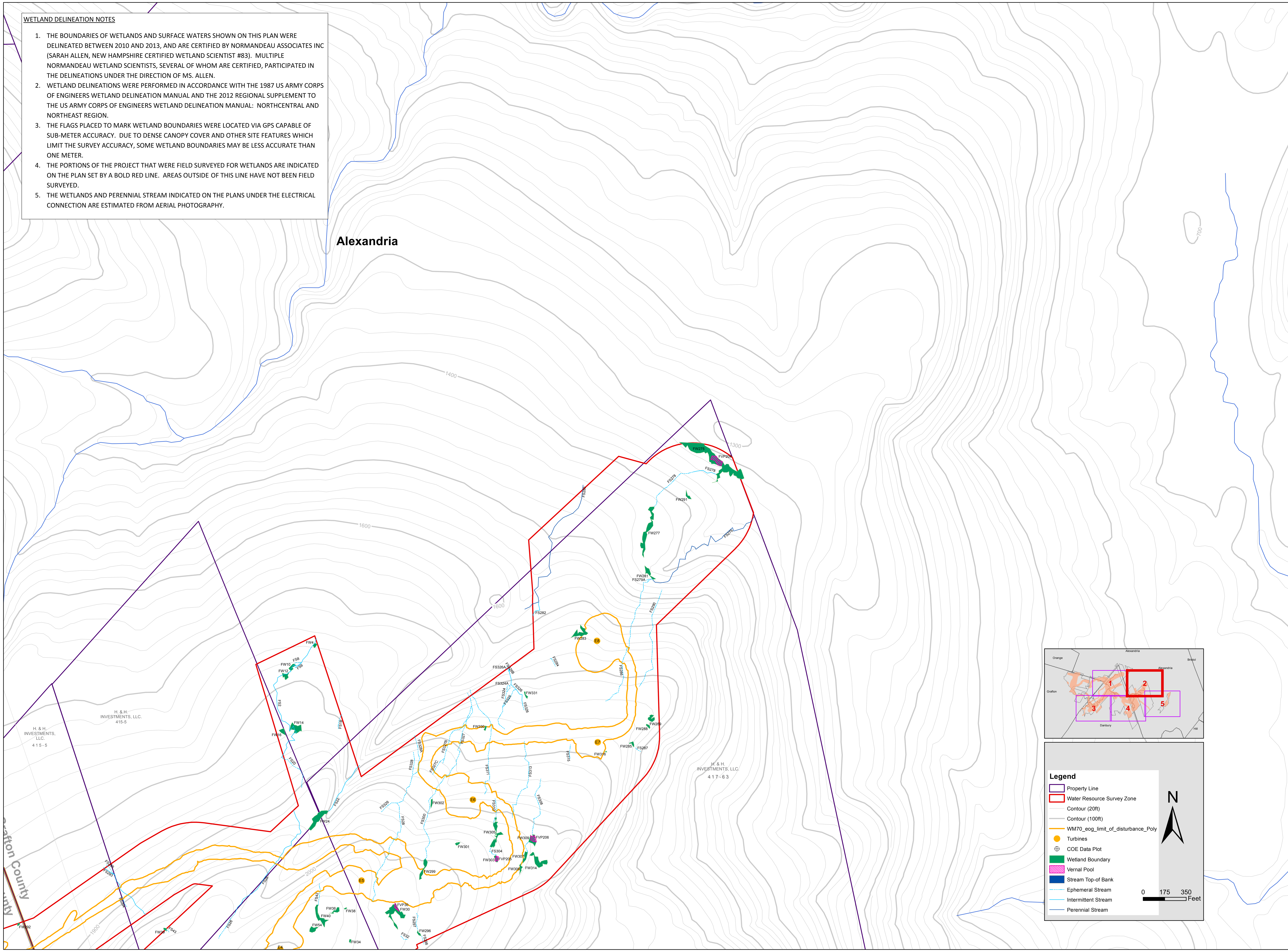

IBERDROLA RENEWABLES

NORMANDEAU environmental consultants

NO.	DATE

DATE: 11/27/2013
PROJECT #:
ENGIN'D BY:
DRAWN BY: dpelletier
CHECK'D BY: SDA
ARCHIVE #:

horizons Engineering
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Littleton, NH 03561
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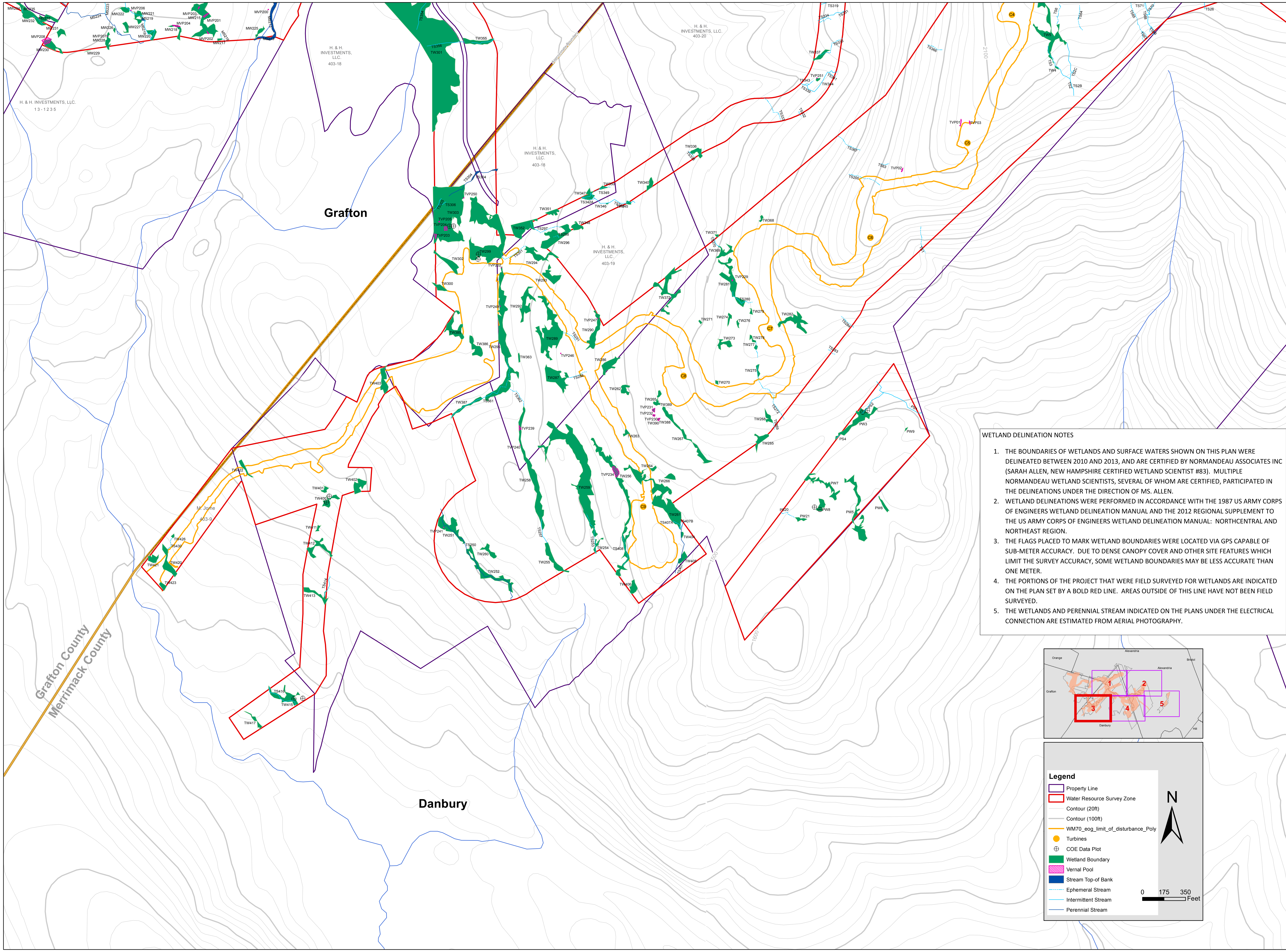
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH
70 PERCENT DESIGN

SHEET TITLE: Existing Conditions
Tile: 2
SHEET NUMBER: W 1.3



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IBERDROLA RENEWABLES

NORMANDEAU environmental consultants

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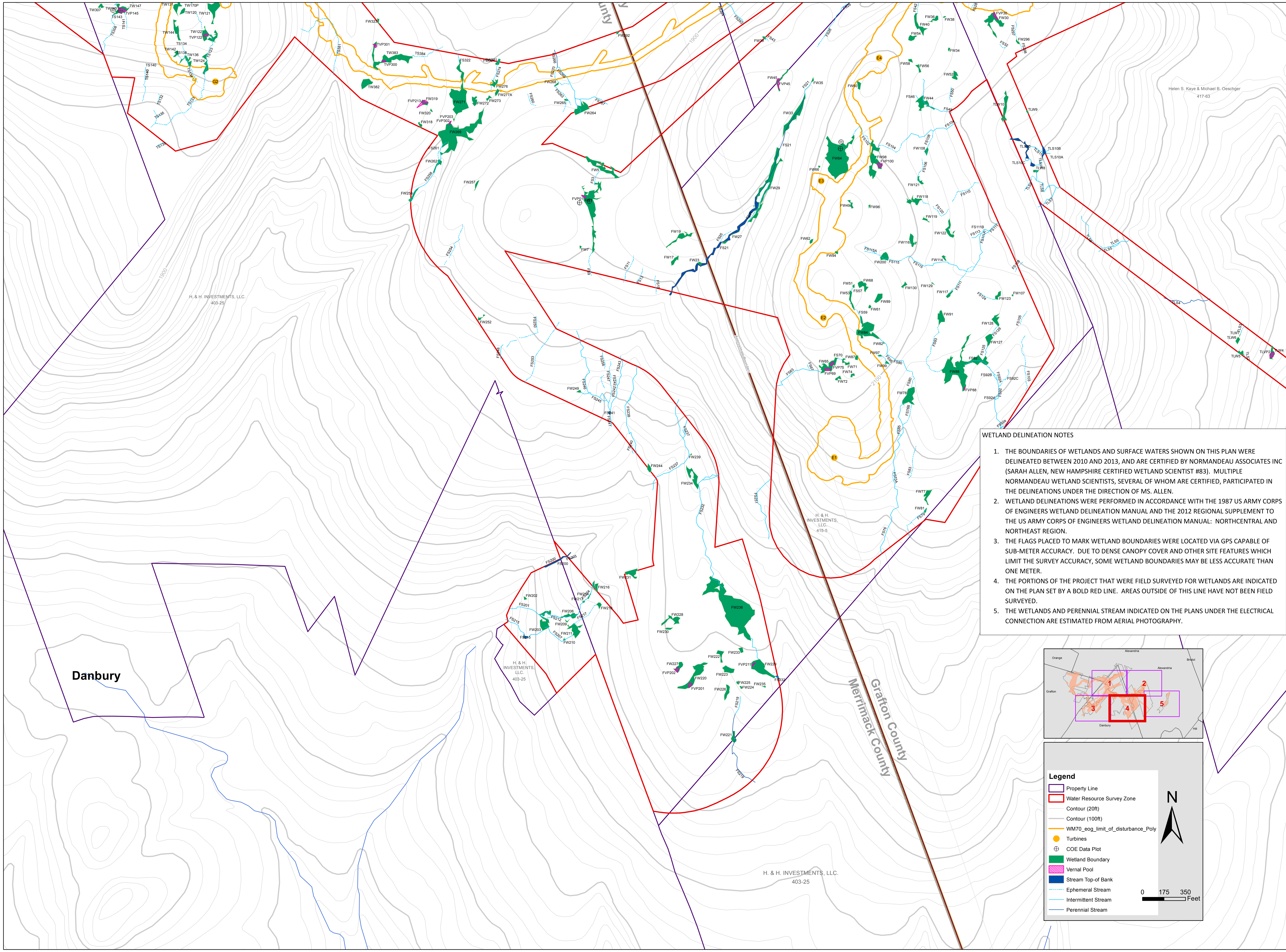
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
Existing Conditions
Tile: 3

SHEET NUMBER: W 1.4



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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
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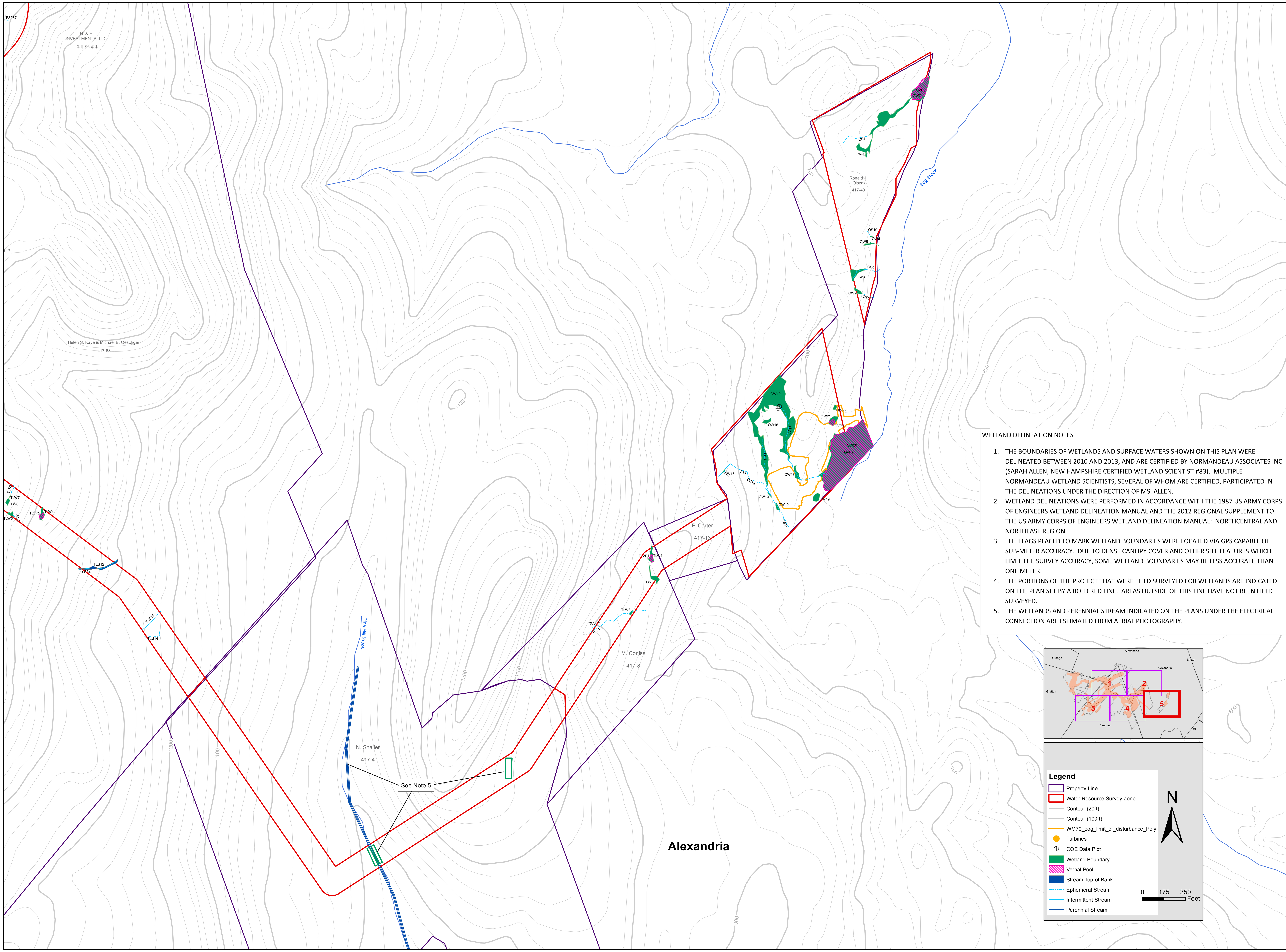
Tile: 4

SHEET NUMBER: W 1.5



WETLAND DELINEATION NOTES

1. THE BOUNDARIES OF WETLANDS AND SURFACE WATERS SHOWN ON THIS PLAN WERE DELINEATED BETWEEN 2010 AND 2013, AND ARE CERTIFIED BY NORMANDEAU ASSOCIATES INC (SARAH ALLEN, NEW HAMPSHIRE CERTIFIED WETLAND SCIENTIST #83). MULTIPLE NORMANDEAU WETLAND SCIENTISTS, SEVERAL OF WHOM ARE CERTIFIED, PARTICIPATED IN THE DELINEATIONS UNDER THE DIRECTION OF MS. ALLEN.
2. WETLAND DELINEATIONS WERE PERFORMED IN ACCORDANCE WITH THE 1987 US ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL AND THE 2012 REGIONAL SUPPLEMENT TO THE US ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL: NORTHCENTRAL AND NORTHEAST REGION.
3. THE FLAGS PLACED TO MARK WETLAND BOUNDARIES WERE LOCATED VIA GPS CAPABLE OF SUB-METER ACCURACY. DUE TO DENSE CANOPY COVER AND OTHER SITE FEATURES WHICH LIMIT THE SURVEY ACCURACY, SOME WETLAND BOUNDARIES MAY BE LESS ACCURATE THAN ONE METER.
4. THE PORTIONS OF THE PROJECT THAT WERE FIELD SURVEYED FOR WETLANDS ARE INDICATED ON THE PLAN SET BY A BOLD RED LINE. AREAS OUTSIDE OF THIS LINE HAVE NOT BEEN FIELD SURVEYED.
5. THE WETLANDS AND PERENNIAL STREAM INDICATED ON THE PLANS UNDER THE ELECTRICAL CONNECTION ARE ESTIMATED FROM AERIAL PHOTOGRAPHY.

IBERDROLA RENEWABLES

NORMANDEAU environmental consultants

DATE:	11/27/2013
PROJECT #:	
ENGIN'D BY:	
DRAWN BY:	dpelletier
CHECK'D BY:	SDA
ARCHIVE #:	

NO. DATE

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

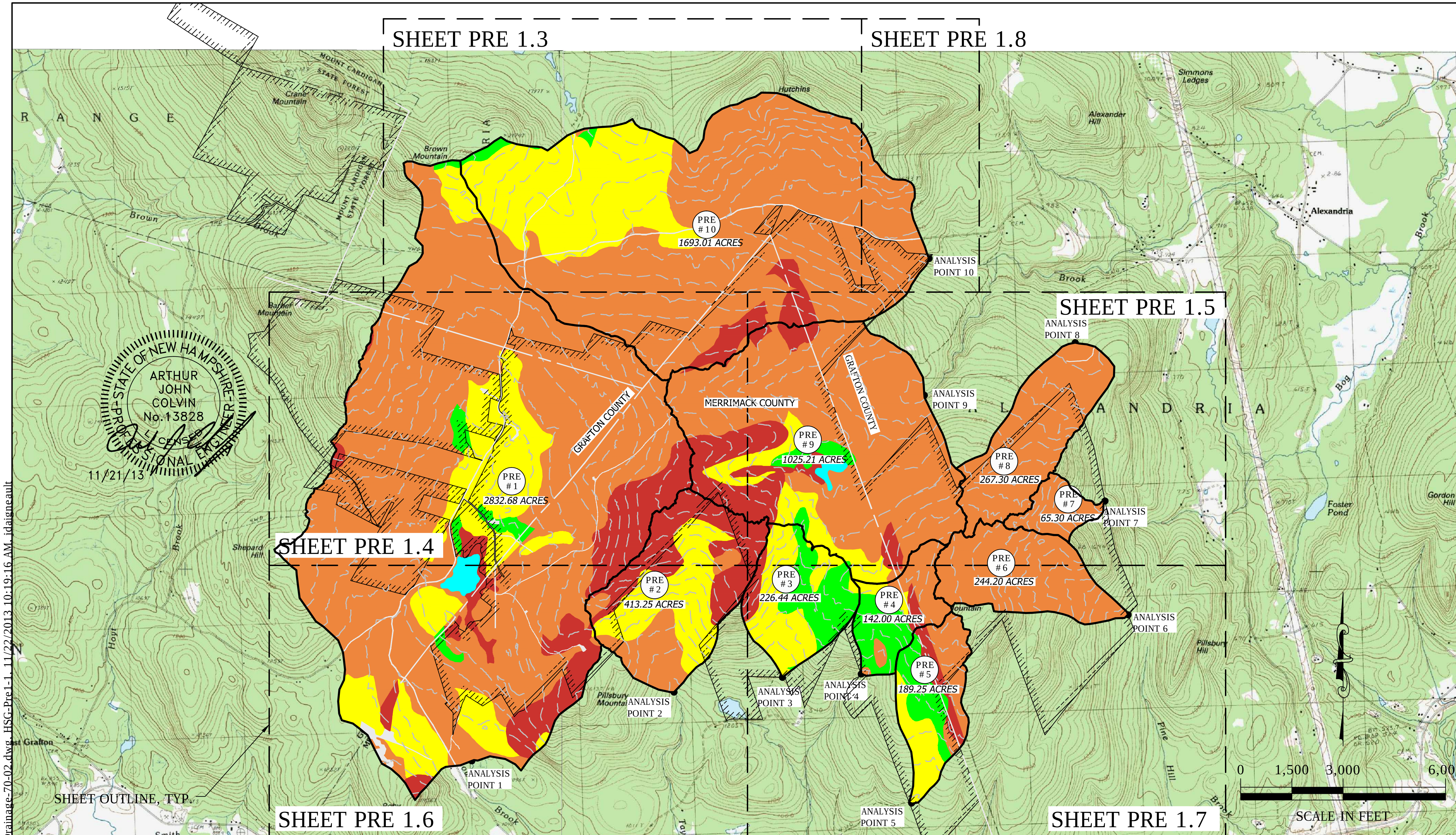
SHEET TITLE:
Existing Conditions

Tile: 5

SHEET NUMBER: W 1.6

4.3 Color Coded Hydrologic Soils Group Plans

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building



PRE-DEVELOPMENT SOIL PLAN - OVERVIEW

NOTES:

1. THESE SOIL PLANS ARE BASED ON NRCS SOILS DATA. SEE NOTE ON SHEET 2.
2. WAIVERS HAVE BEEN REQUESTED OF THE FOLLOWING REQUIREMENTS: SITE SPECIFIC SOIL MAPPING (EXCEPT IN LIMITED AREAS), AND 2-FOOT CONTOURS ON THE SOIL PLAN.
3. THE PROJECT SITE INCLUDES AREA IN SEVERAL TOWNS IN GRAFTON AND MERRIMACK COUNTIES. NRCS SOIL SURVEY BOUNDARIES ARE TIED TO TOWN BOUNDARIES SHOWN ON THE USGS QUADRANGLE MAPS. THE BOUNDARIES ARE MARKED AS INDEFINITE IN THIS LOCATION, THEREFORE THE USGS AND SOIL BOUNDARIES DO NOT CORRESPOND WITH SURVEYED PROPERTY BOUNDARIES.

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER

- PRE #1 — SUBCATCHMENT LABEL
- SUBCATCHMENT BOUNDARY
- NRCS SOIL SERIES BOUNDARY
- 709D — NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)
- PROJECT LEASE AREA
- WETLAND OR STREAM

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

PRE-DEVELOPMENT SOIL PLAN
OVERVIEW - SHEET INDEX

SHEET PRE 1.1

Grafton County, New Hampshire (NH009)

Map Unit Symbol	Map Unit Name
28A	Madawaska fine sandy loam, 0 to 3 percent slopes
36B	Adams loamy sand, 3 to 8 percent slopes
36E	Adams loamy sand, 15 to 60 percent slopes
57E	Becket fine sandy loam, 25 to 35 percent slopes,very stony
59B	Waumbek loamy sand, 3 to 8 percent slopes, very stony
61E	Tunbridge-Lyman-Rock outcrop complex, 25 to 60 percent slopes
72B	Berkshire loam, 3 to 8 percent slopes
72C	Berkshire loam, 8 to 15 percent slopes
73B	Berkshire loam, 3 to 8 percent slopes, very stony
90B	Tunbridge-Lyman complex, 3 to 8 percent slopes
90C	Tunbridge-Lyman complex, 8 to 15 percent slopes
90D	Tunbridge-Lyman complex, 15 to 25 percent slopes
254C	Monadnock and Hermon soils, 8 to 15 percent slopes
255E	Monadnock and Hermon soils, 25 to 35 percent slopes, very stony
347A	Lyme and Moosilauke soils, 0 to 3 percent slopes, very stony
395	Chocorua mucky peat
701B	Becket-Skerry association, gently sloping, very stony
703E	Becket-Monadnock association, steep, very stony
709D	Becket-Tunbridge association, hilly, very stony
709E	Becket-Tunbridge association, steep, very stony
710D	Becket-Lyman-Rock outcrop complex, hilly
710E	Becket-Lyman-Rock outcrop complex, steep
711B	Monadnock-Hermon association, undulating, very stony
711D	Monadnock-Hermon association, hilly, very stony
712B	Hermon-Monadnock association, undulating, extremely bouldery
712D	Hermon-Monadnock association, hilly, extremely bouldery
713B	Hermon-Waumbek association, undulating, very stony
713D	Hermon-Waumbek association, hilly, very stony
717	Lyme-Peacham association, very stony
720D	Marlow-Lyman-Rock outcrop complex, hilly
721B	Peru-Marlow association, gently sloping, very stony
723B	Peru-Pillsbury association, gently sloping, very stony
724B	Skerry-Tunbridge association, undulating, very stony
726D	Rock outcrop-Lyman complex, hilly
729B	Waumbek-Lyme association, undulating, very stony
730B	Skerry-Lyman-Rock outcrop complex, undulating
819B	Peru-Tunbridge association, undulating, very stony
W	Water

Merrimack and Belknap Counties, New Hampshire (NH609)

Map Unit Symbol	Map Unit Name
17A	Searsport-Chocorua-Naumburg complex, 0 to 1 percent slopes
55E	Hermon fine sandy loam, 25 to 35 percent slopes, very stony
56C	Becket fine sandy loam, 8 to 15 percent slopes
57B	Becket fine sandy loam, 3 to 8 percent slopes, very stony
57C	Becket fine sandy loam, 8 to 15 percent slopes, very stony
57D	Becket fine sandy loam, 15 to 25 percent slopes, very stony
57E	Becket fine sandy loam, 25 to 35 percent slopes, very stony
77D	Marlow fine sandy loam, 15 to 25 percent slopes, very stony
77E	Marlow fine sandy loam, 25 to 35 percent slopes, very stony
105A	Rumney very fine sandy loam, 0 to 3 percent slopes, frequently flooded
143B	Monadnock sandy loam, 3 to 8 percent slopes, very stony
143D	Monadnock sandy loam, 15 to 25 percent slopes, very stony
143E	Monadnock sandy loam, 25 to 35 percent slopes, very stony
161C	Lyman-Tunbridge-Rock outcrop complex, 8 to 15 percent slopes
161D	Lyman-Tunbridge-Rock outcrop complex, 15 to 35 percent slopes
161E	Lyman-Tunbridge-Rock outcrop complex, 35 to 60 percent slopes
244D	Hermon-Monadnock Complex, 15 to 25 percent slopes, very stony
379B	Dixfield fine sandy loam, 3 to 8 percent slopes, very stony
379C	Dixfield fine sandy loam, 8 to 15 percent slopes, very stony
380B	Tunbridge-Lyman-Becket complex, 3 to 8 percent slopes, very stony
380C	Tunbridge-Lyman-Becket complex, 8 to 15 percent slopes, very stony
380D	Tunbridge-Lyman-Becket complex, 15 to 25 percent slopes, very stony
380E	Tunbridge-Lyman-Becket complex, 25 to 60 percent slopes, very stony
394A	Chocorua mucky peat, 0 to 1 percent slopes
399E	Rock outcrop, 3 to 80 percent slopes
415B	Moosilauke fine sandy loam, 3 to 8 percent slopes, very stony
543C	Monadnock-Becket-Skerry complex, 8 to 15 percent slopes, very stony
559B	Skerry fine sandy loam, 3 to 8 percent slopes, very stony
559C	Skerry fine sandy loam, 8 to 15 percent slopes, very stony
559D	Skerry fine sandy loam, 15 to 25 percent slopes, very stony
647B	Pillsbury sandy loam, 3 to 8 percent slopes, very stony
649A	Peacham cobbly mucky fine sandy loam, 0 to 1 percent slopes, extremely stony
W	Water

SOIL DATA SOURCE

SOILS DATA WAS OBTAINED FROM THE NATURAL RESOURCES CONSERVATION SERVICE (NRCS) WEB SOILS SURVEY (http://websoilsurvey.nrcs.usda.gov), INCLUDING SOIL MAP UNITS, SOIL DESCRIPTIONS, HYDROLOGIC SOILS GROUP, AND DIGITAL SOIL BOUNDARIES ON OCTOBER 16, 2012. GRAFTON COUNTY DATA ARE VERSION 15, AUG. 27, 2012 AND MERRIMACK COUNTY ARE VERSION 17, OCT. 27 2009.

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED PROFESSIONAL ENGINEER
11/21/13

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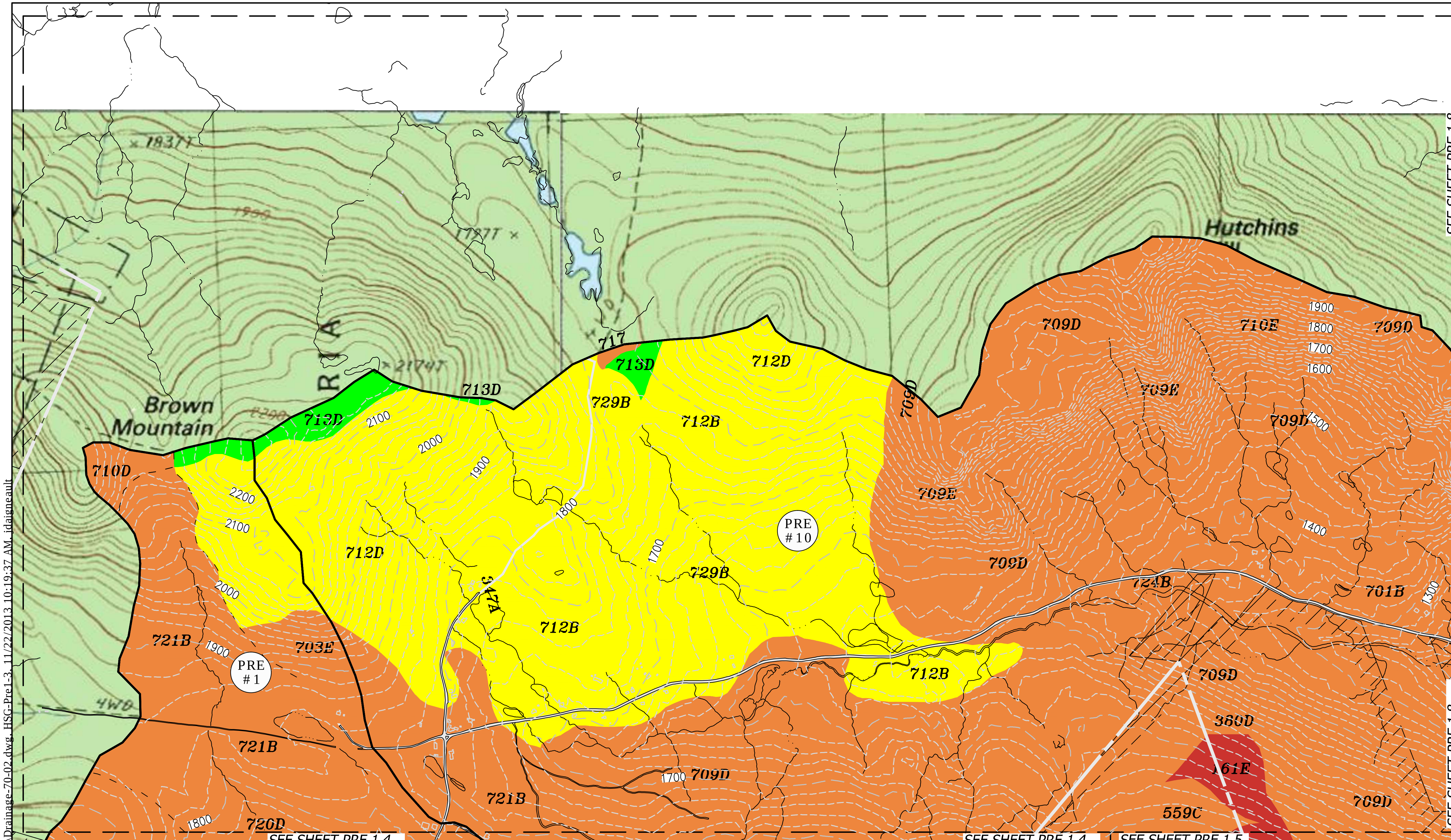
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

PRE-DEVELOPMENT SOIL PLAN
SOIL SERIES LEGEND

SHEET PRE 1.2



PRE-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000

SCALE IN FEET

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED
PROFESSIONAL ENGINEER

11/21/13

COLOR CODED SOIL PLANS SYMBOL KEY

HSG A	
HSG B	
HSG C	
HSG D	
IMPERVIOUS	
WATER	
PRE #1	SUBCATCHMENT LABEL
	SUBCATCHMENT BOUNDARY
	NRCS SOIL SERIES BOUNDARY
709D	NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)
	PROJECT LEASE AREA
	WETLAND OR STREAM

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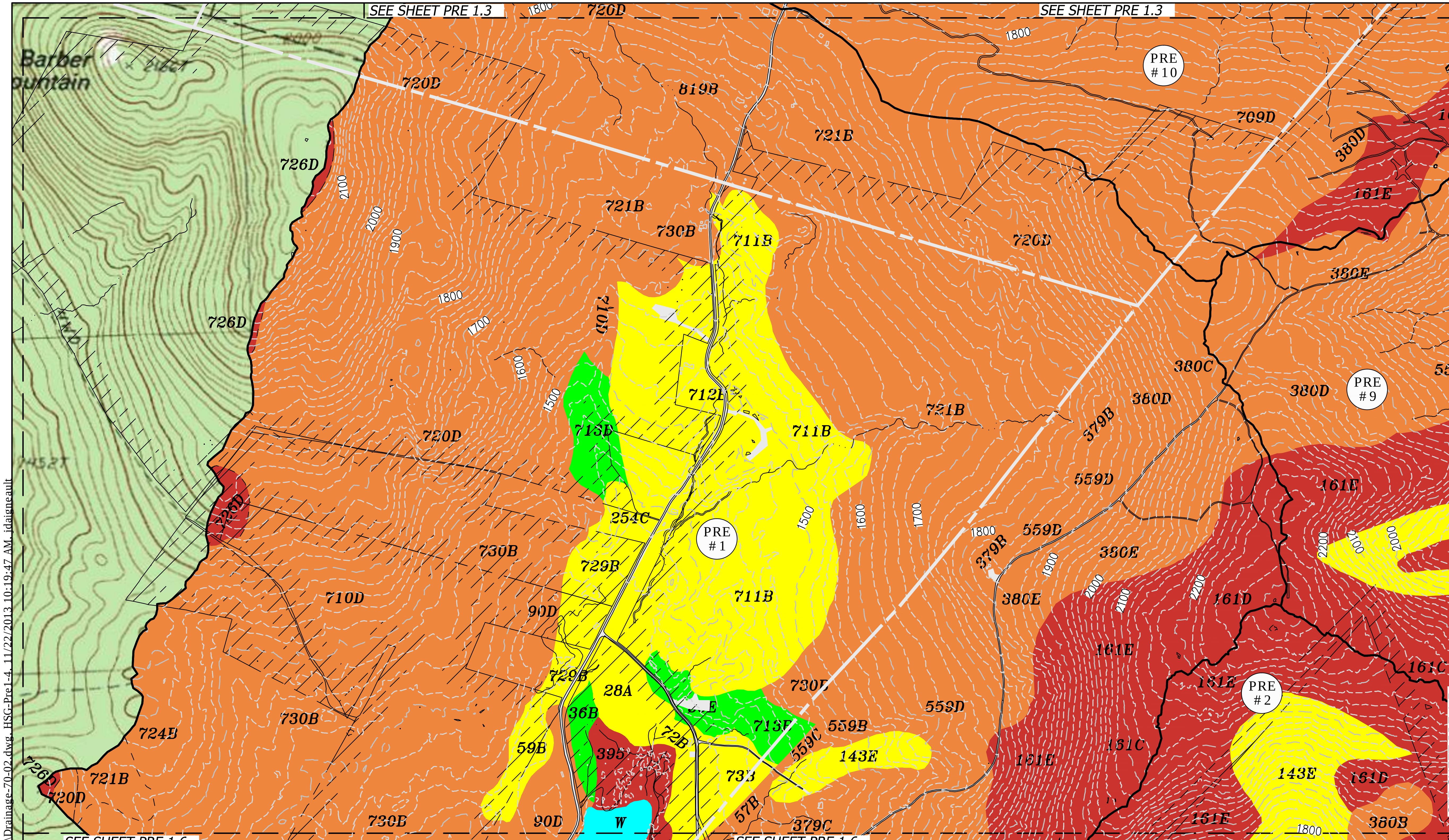
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

PRE-DEVELOPMENT SOIL PLAN

SHEET PRE 1.3



PRE-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000

SCALE IN FEET

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER

PRE #1 SUBCATCHMENT LABEL

SUBCATCHMENT BOUNDARY

NRCS SOIL SERIES BOUNDARY

709D NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)

PROJECT LEASE AREA

WETLAND OR STREAM

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN No.13828
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11/21/13

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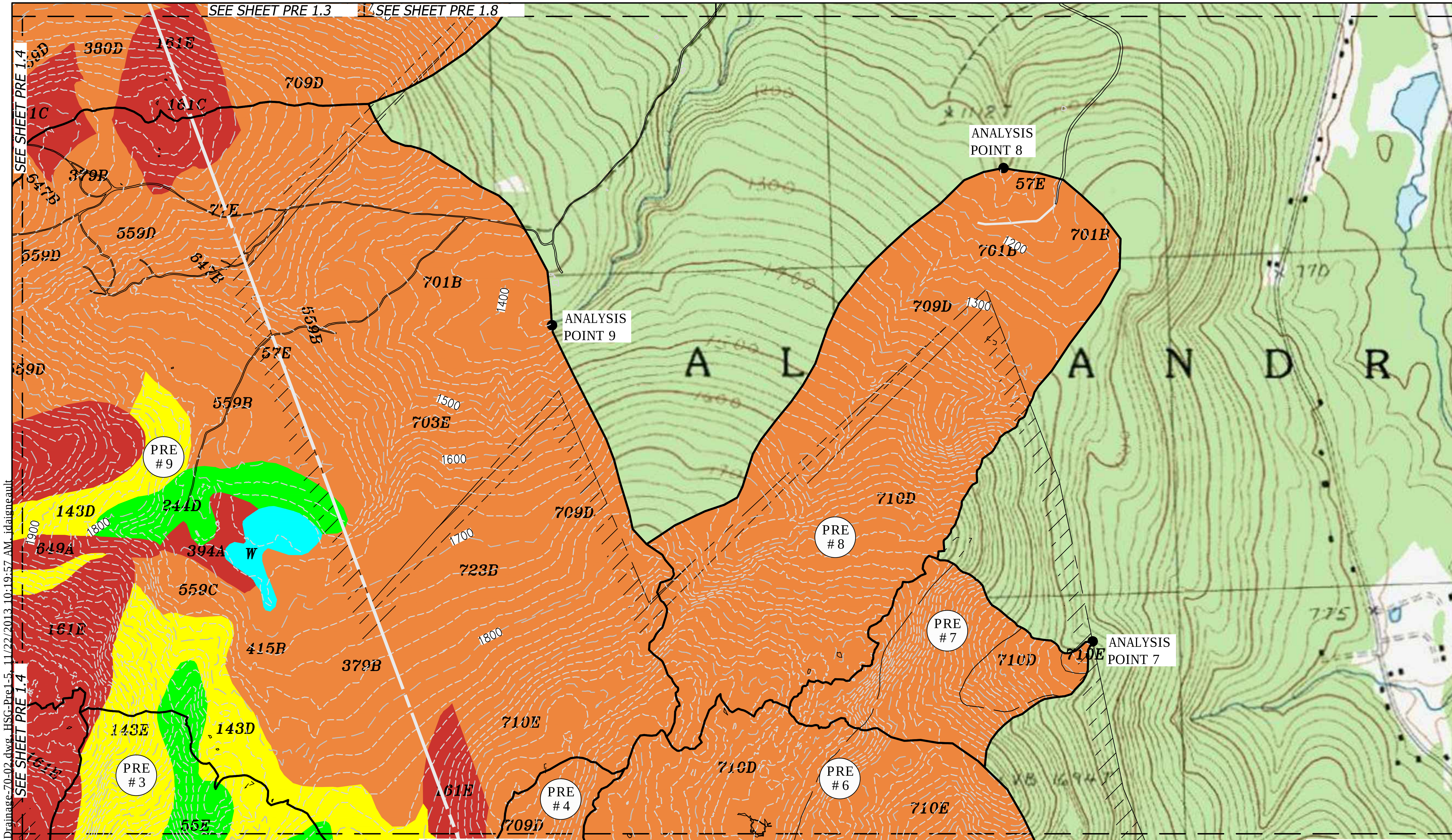
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

PRE-DEVELOPMENT SOIL PLAN

SHEET PRE 1.4



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PRE-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000

SCALE IN FEET

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED
PROFESSIONAL ENGINEER

11/21/13

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER

PRE #1 SUBCATCHMENT LABEL

SUBCATCHMENT BOUNDARY

NRCS SOIL SERIES BOUNDARY

709D NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)

PROJECT LEASE AREA

WETLAND OR STREAM

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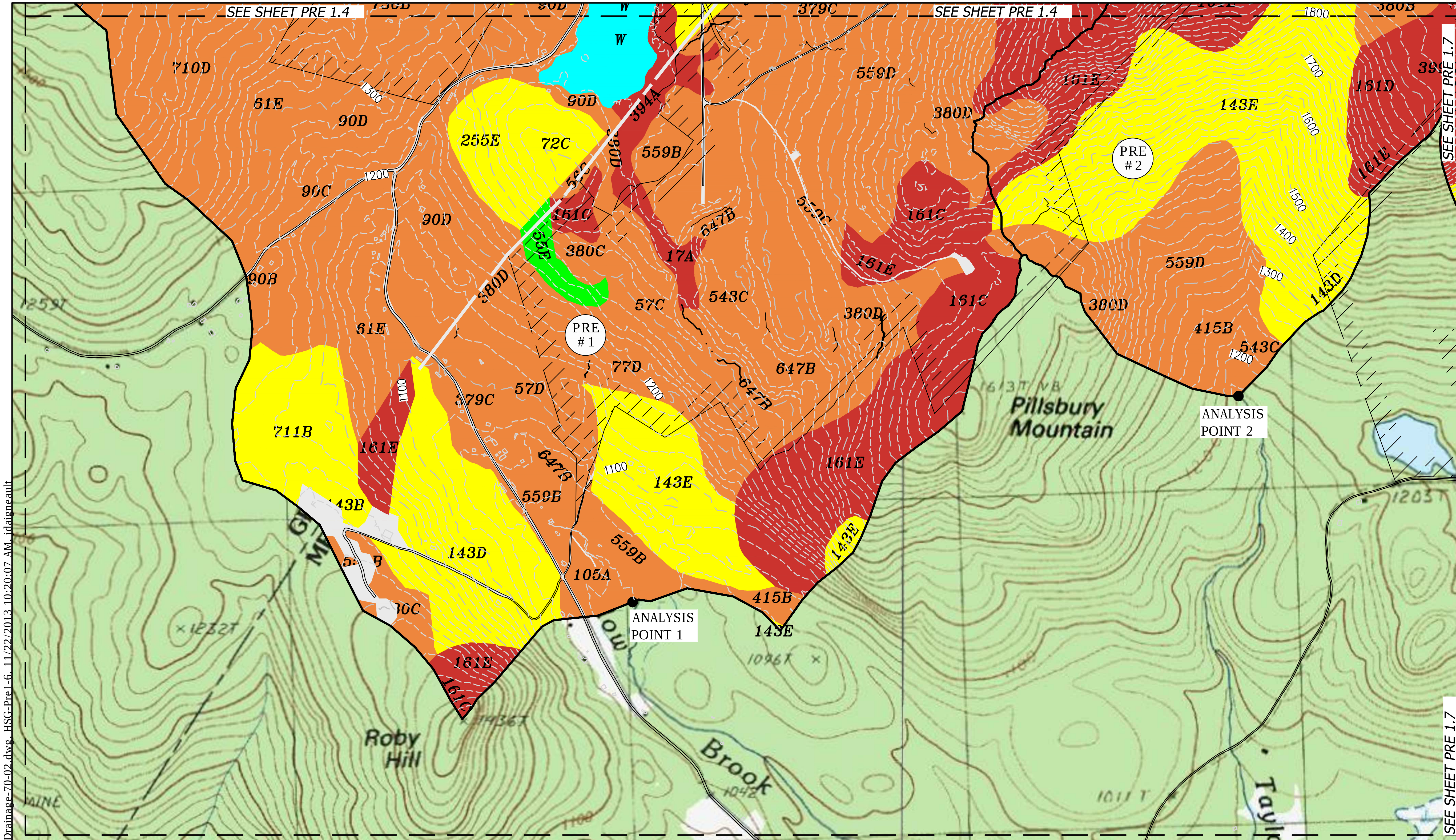
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

PRE-DEVELOPMENT SOIL PLAN

SHEET PRE 1.5



PRE-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000

SCALE IN FEET

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER
- PRE #1 SUBCATCHMENT LABEL
- SUBCATCHMENT BOUNDARY
- NRCS SOIL SERIES BOUNDARY
- 709D NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)
- PROJECT LEASE AREA
- WETLAND OR STREAM

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN No.13828
LICENSED PROFESSIONAL ENGINEER

11/21/13

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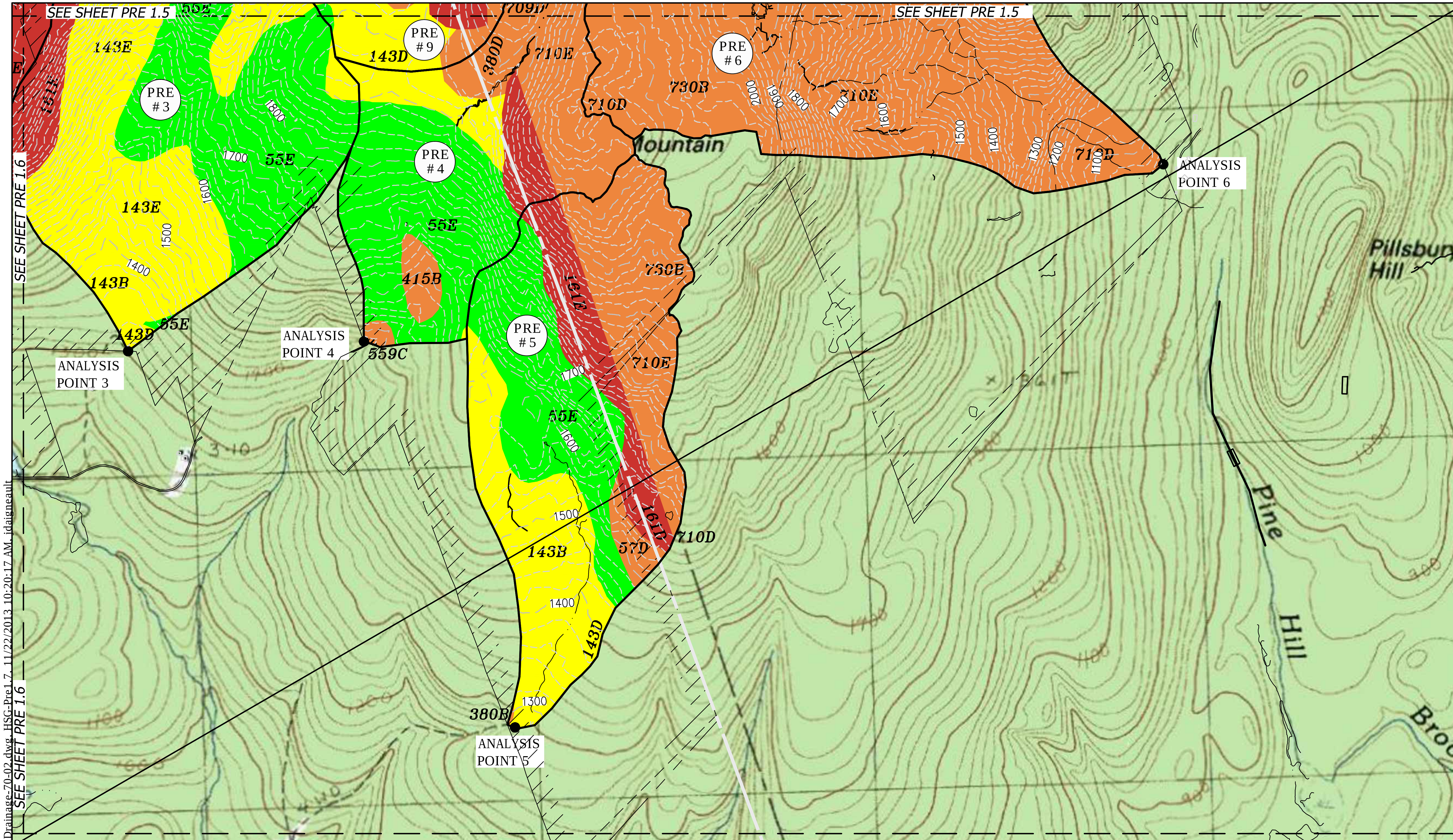
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

PRE-DEVELOPMENT SOIL PLAN

SHEET PRE 1.6



PRE-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000
SCALE IN FEET

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED
PROFESSIONAL ENGINEER
11/21/13

COLOR CODED SOIL PLANS SYMBOL KEY

HSG A	PRE #1 SUBCATCHMENT LABEL
HSG B	SUBCATCHMENT BOUNDARY
HSG C	NRCS SOIL SERIES BOUNDARY
HSG D	709D NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)
IMPERVIOUS	PROJECT LEASE AREA
WATER	WETLAND OR STREAM

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

PRE-DEVELOPMENT SOIL PLAN

SHEET PRE 1.7

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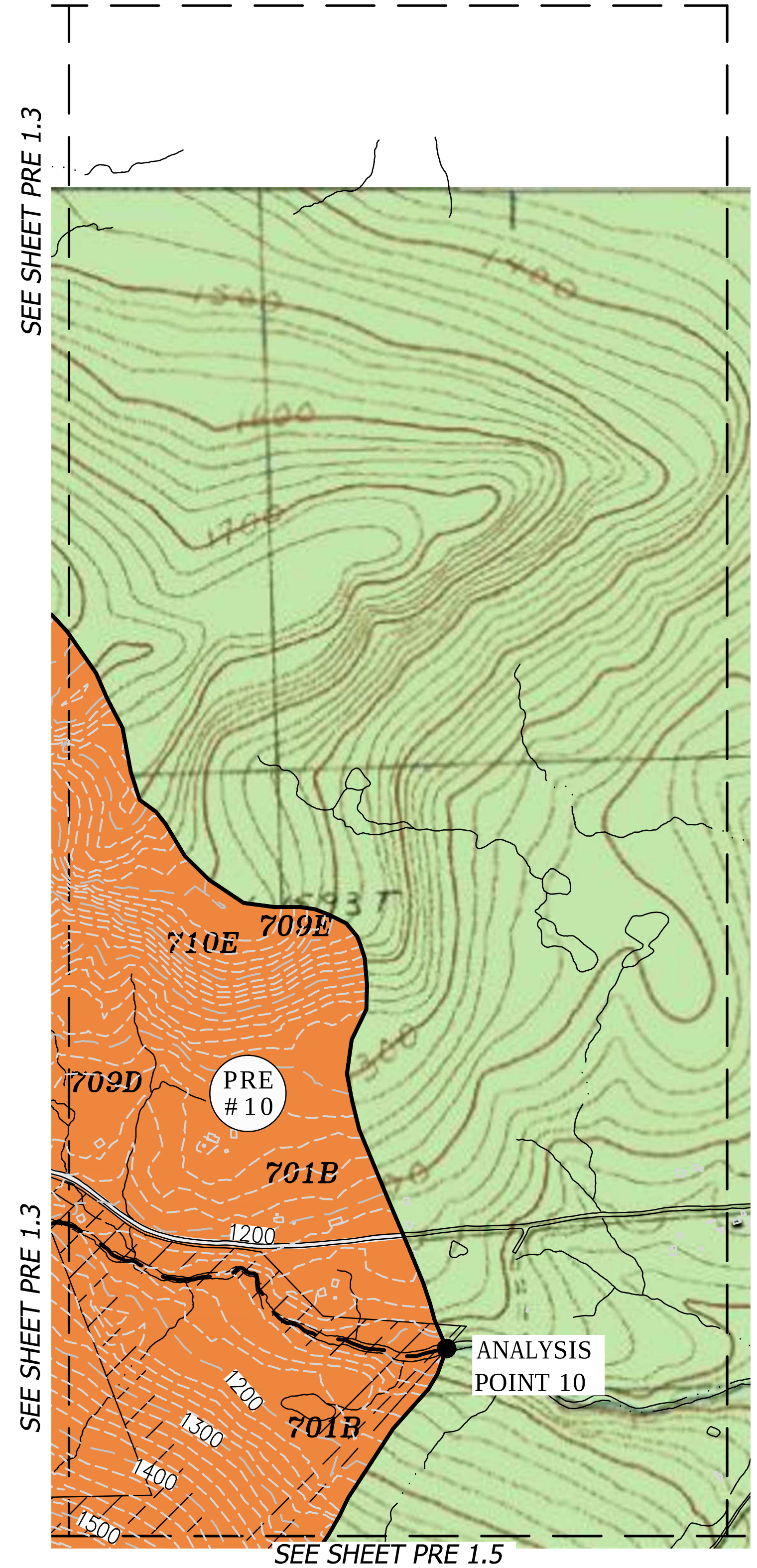

PRE-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000
SCALE IN FEET

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER
- PRE #1 SUBCATCHMENT LABEL
- SUBCATCHMENT BOUNDARY
- NRCS SOIL SERIES BOUNDARY
- 709D NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)
- PROJECT LEASE AREA
- WETLAND OR STREAM

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No.13828 LICENSED PROFESSIONAL ENGINEER
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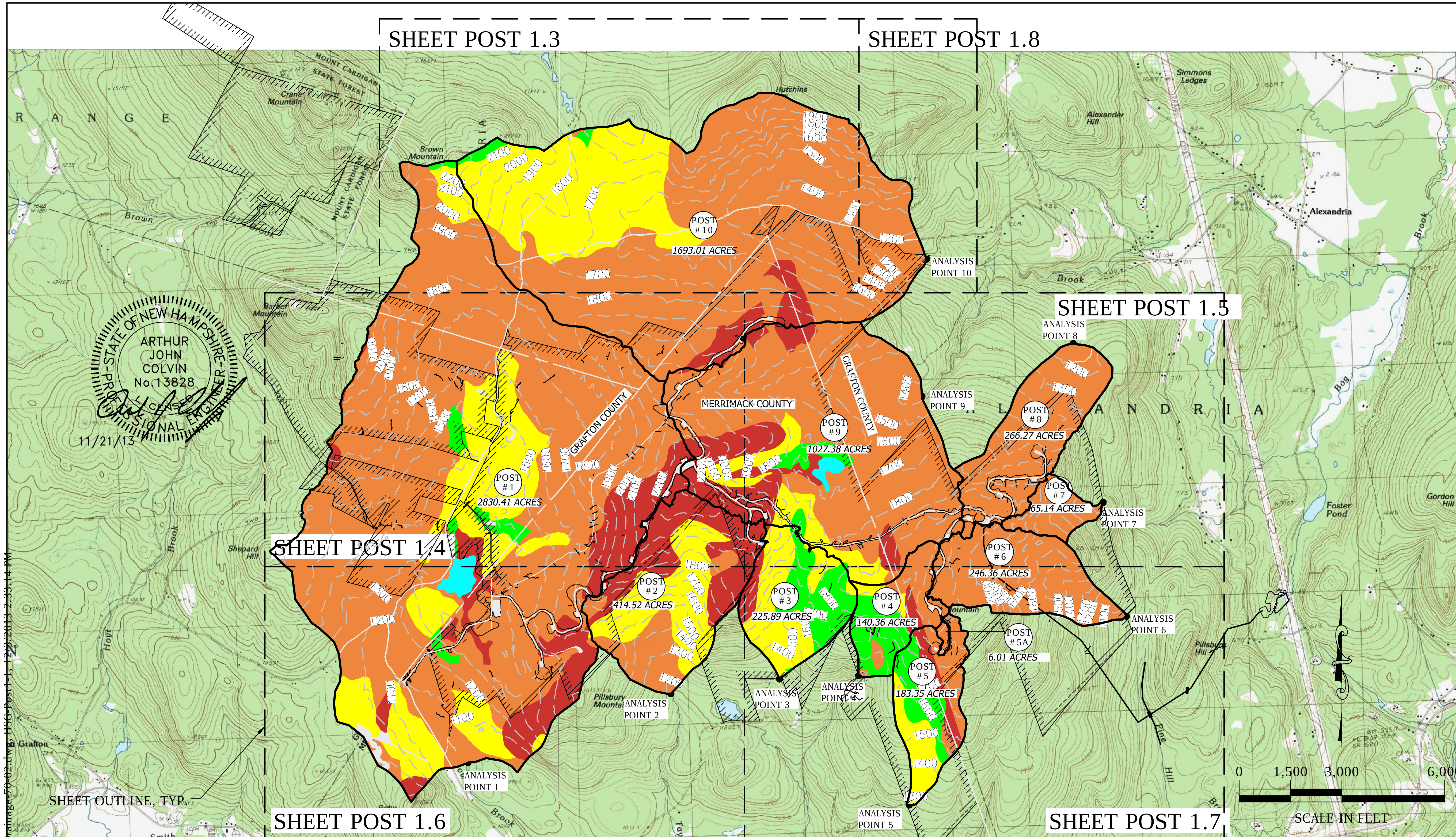
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

PRE-DEVELOPMENT SOIL PLAN

SHEET PRE 1.8



POST-DEVELOPMENT SOIL PLAN - OVERVIEW

NOTES:

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2. WAIVERS HAVE BEEN REQUESTED OF THE FOLLOWING REQUIREMENTS: SITE SPECIFIC SOIL MAPPING (EXCEPT IN LIMITED AREAS), AND 2-FOOT CONTOURS ON THE SOIL PLAN.
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COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
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- HSG D
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- WATER

- PRE #1 — SUBCATCHMENT LABEL
- SUBCATCHMENT BOUNDARY
- NRCS SOIL SERIES BOUNDARY
- 709D — NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)
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- WETLAND OR STREAM

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

POST-DEVELOPMENT SOIL PLAN
OVERVIEW - SHEET INDEX

SHEET POST 1.1

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819B	Peru-Tunbridge association, undulating, very stony
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Merrimack and Belknap Counties, New Hampshire (NH609)

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161D	Lyman-Tunbridge-Rock outcrop complex, 15 to 35 percent slopes
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543C	Monadnock-Becket-Skerry complex, 8 to 15 percent slopes, very stony
559B	Skerry fine sandy loam, 3 to 8 percent slopes, very stony
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559D	Skerry fine sandy loam, 15 to 25 percent slopes, very stony
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W	Water

SOIL DATA SOURCE

SOILS DATA WAS OBTAINED FROM THE NATURAL RESOURCES CONSERVATION SERVICE (NRCS) WEB SOILS SURVEY (http://websoilsurvey.nrcs.usda.gov), INCLUDING SOIL MAP UNITS, SOIL DESCRIPTIONS, HYDROLOGIC SOILS GROUP, AND DIGITAL SOIL BOUNDARIES ON OCTOBER 16, 2012. GRAFTON COUNTY DATA ARE VERSION 15, AUG. 27, 2012 AND MERRIMACK COUNTY ARE VERSION 17, OCT. 27 2009.

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED
PROFESSIONAL ENGINEER

11/21/13

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IBERDROLA RENEWABLES

horizons Engineering Inc
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Littleton, NH 03561
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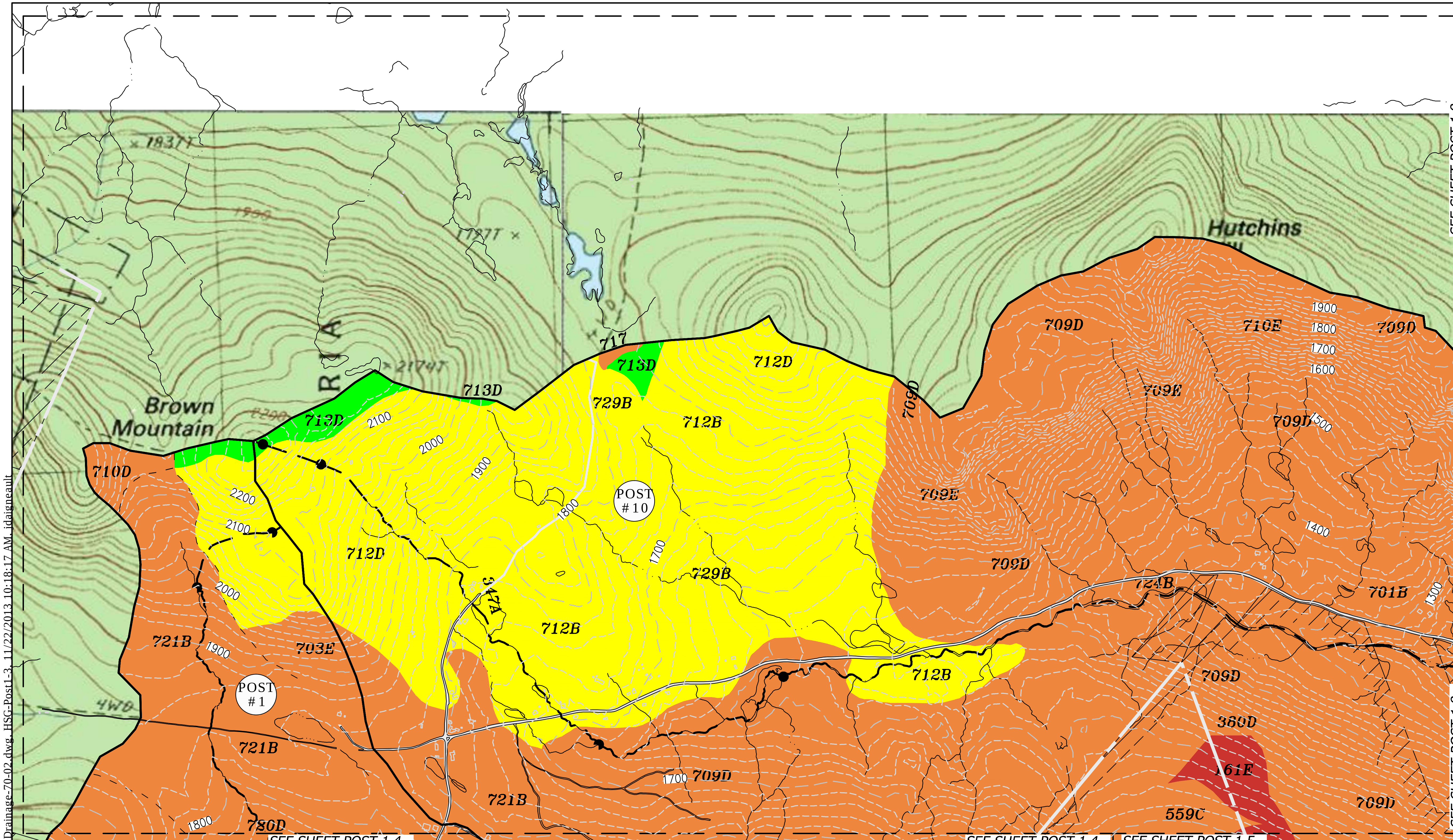
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

POST-DEVELOPMENT SOIL PLAN
SOIL SERIES LEGEND

SHEET POST 1.2



POST-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000

SCALE IN FEET

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER

PRE #1 SUBCATCHMENT LABEL

SUBCATCHMENT BOUNDARY

NRCS SOIL SERIES BOUNDARY

709D NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)

PROJECT LEASE AREA

WETLAND OR STREAM

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED
PROFESSIONAL ENGINEER

11/21/13

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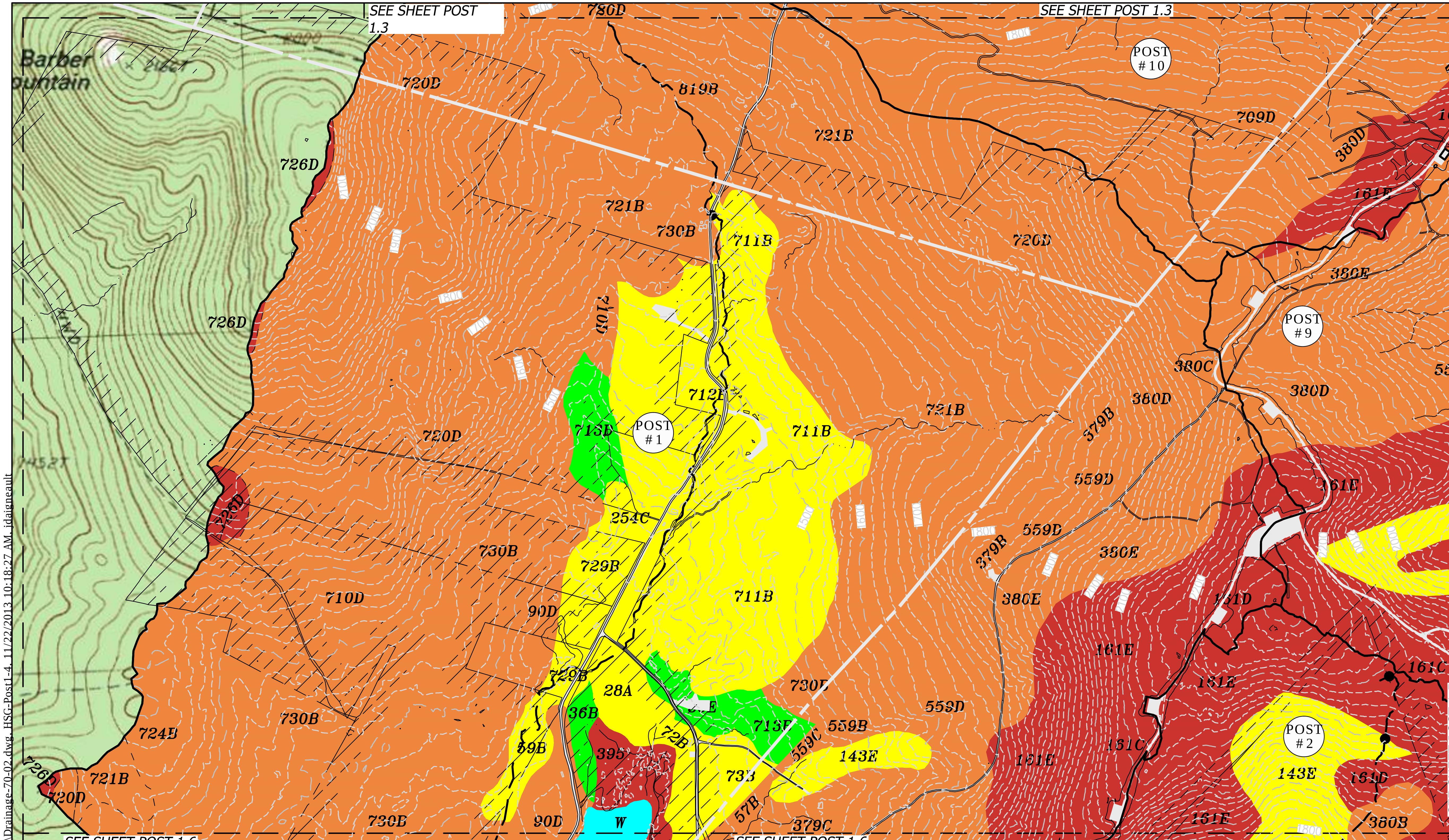
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

POST-DEVELOPMENT SOIL PLAN

SHEET POST 1.3



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POST-DEVELOPMENT SOIL PLAN

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED
PROFESSIONAL ENGINEER

11/21/13

0 500 1,000 2,000

SCALE IN FEET

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER

PRE #1 SUBCATCHMENT LABEL

SUBCATCHMENT BOUNDARY

NRCS SOIL SERIES BOUNDARY

709D NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)

PROJECT LEASE AREA

WETLAND OR STREAM

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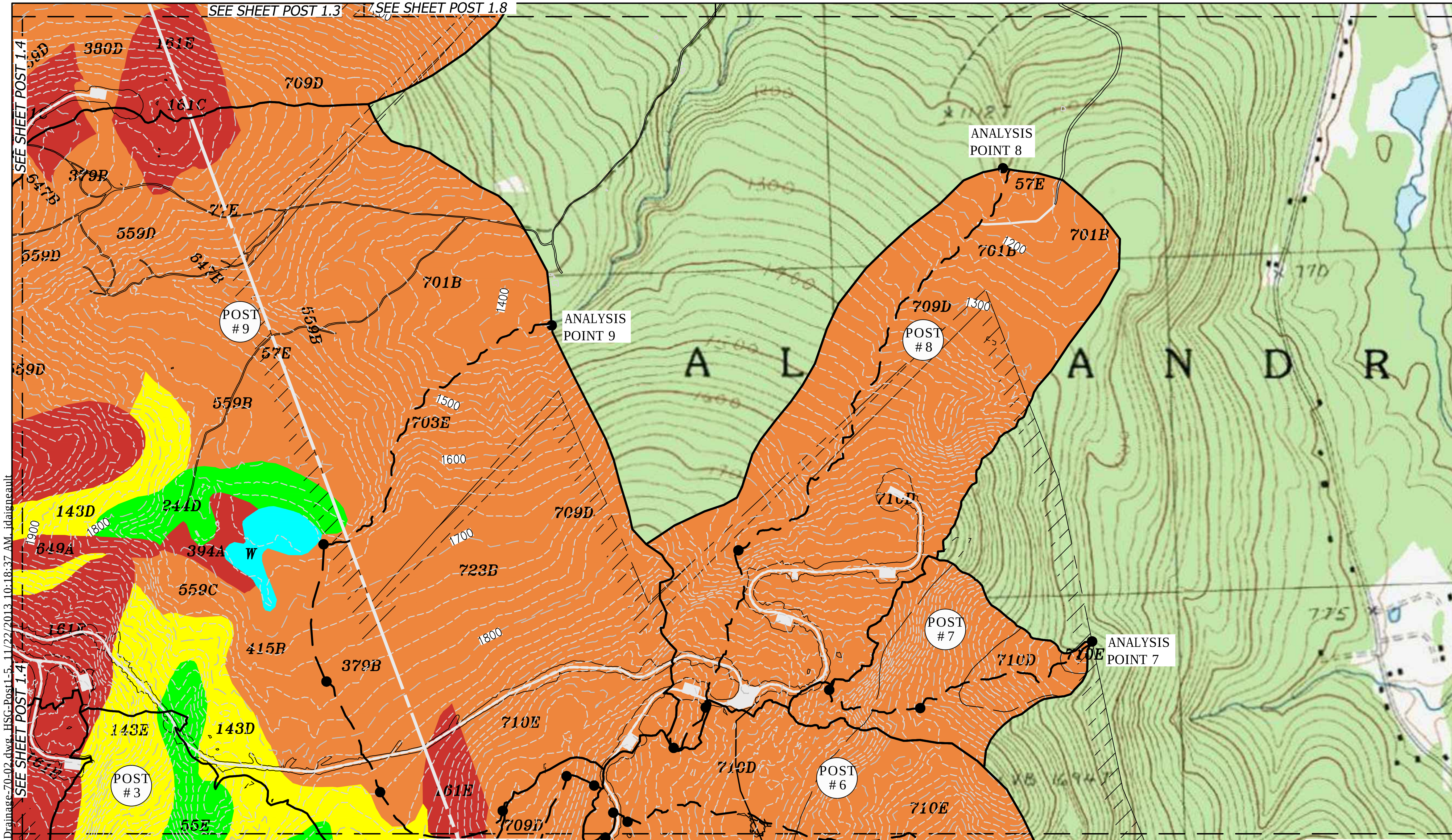
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

POST-DEVELOPMENT SOIL PLAN

SHEET POST 1.4



POST-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000

SCALE IN FEET

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER

PRE
#1
SUBCATCHMENT LABEL

SUBCATCHMENT BOUNDARY

NRCS SOIL SERIES BOUNDARY

709D NRCS SOIL SERIES LABEL
(SEE SHT. 2.2 FOR SOIL SERIES LEGEND)

PROJECT LEASE AREA

WETLAND OR STREAM

STATE OF NEW HAMPSHIRE
ARTHUR
JOHN
COLVIN
No.13828
LICENSED
PROFESSIONAL ENGINEER

11/21/13

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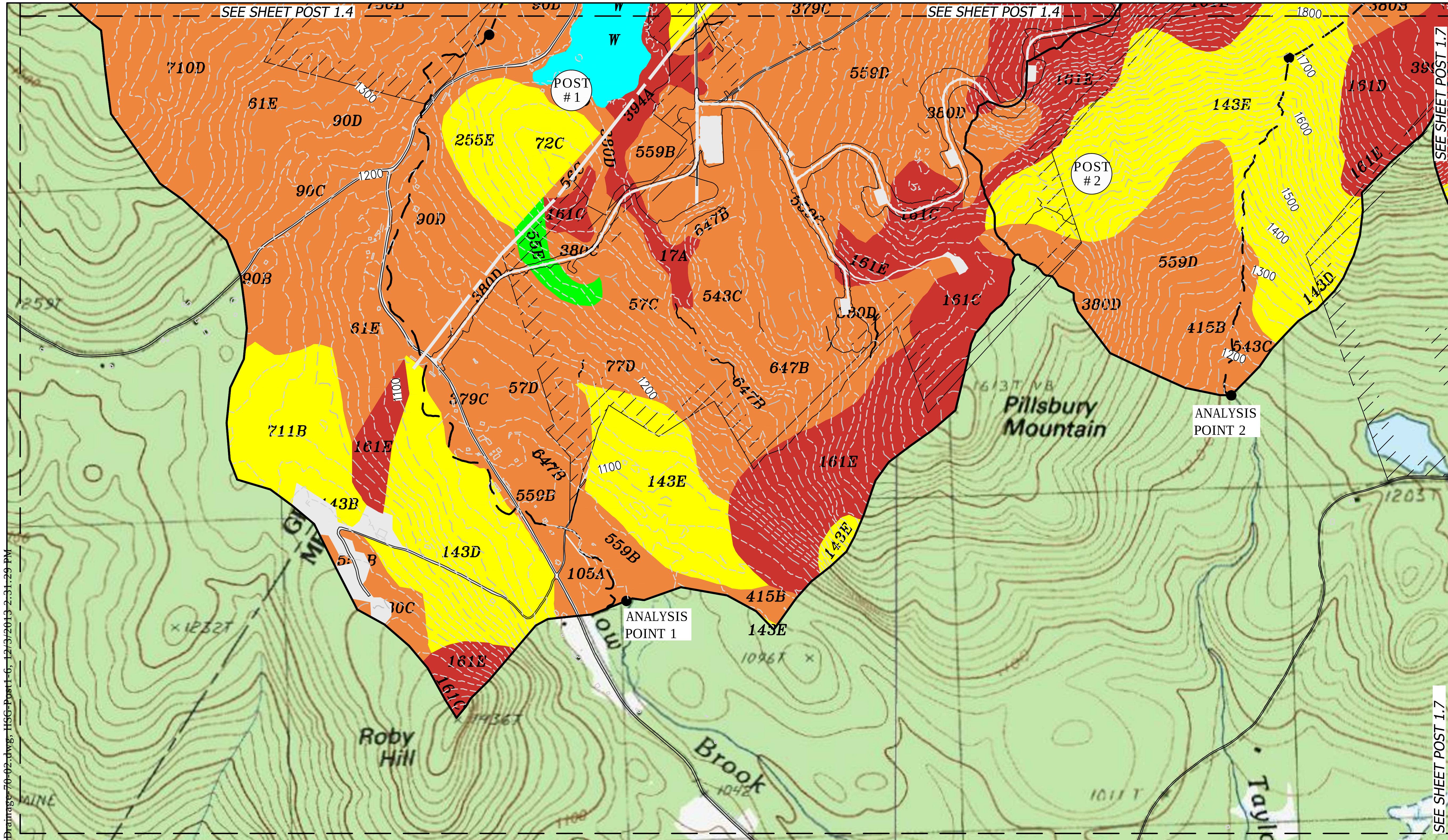
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

POST-DEVELOPMENT SOIL PLAN

SHEET POST 1.5



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POST-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000

SCALE IN FEET

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED PROFESSIONAL ENGINEER

11/21/13

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER

PRE #1 SUBCATCHMENT LABEL

SUBCATCHMENT BOUNDARY

NRCS SOIL SERIES BOUNDARY

709D NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)

PROJECT LEASE AREA

WETLAND OR STREAM

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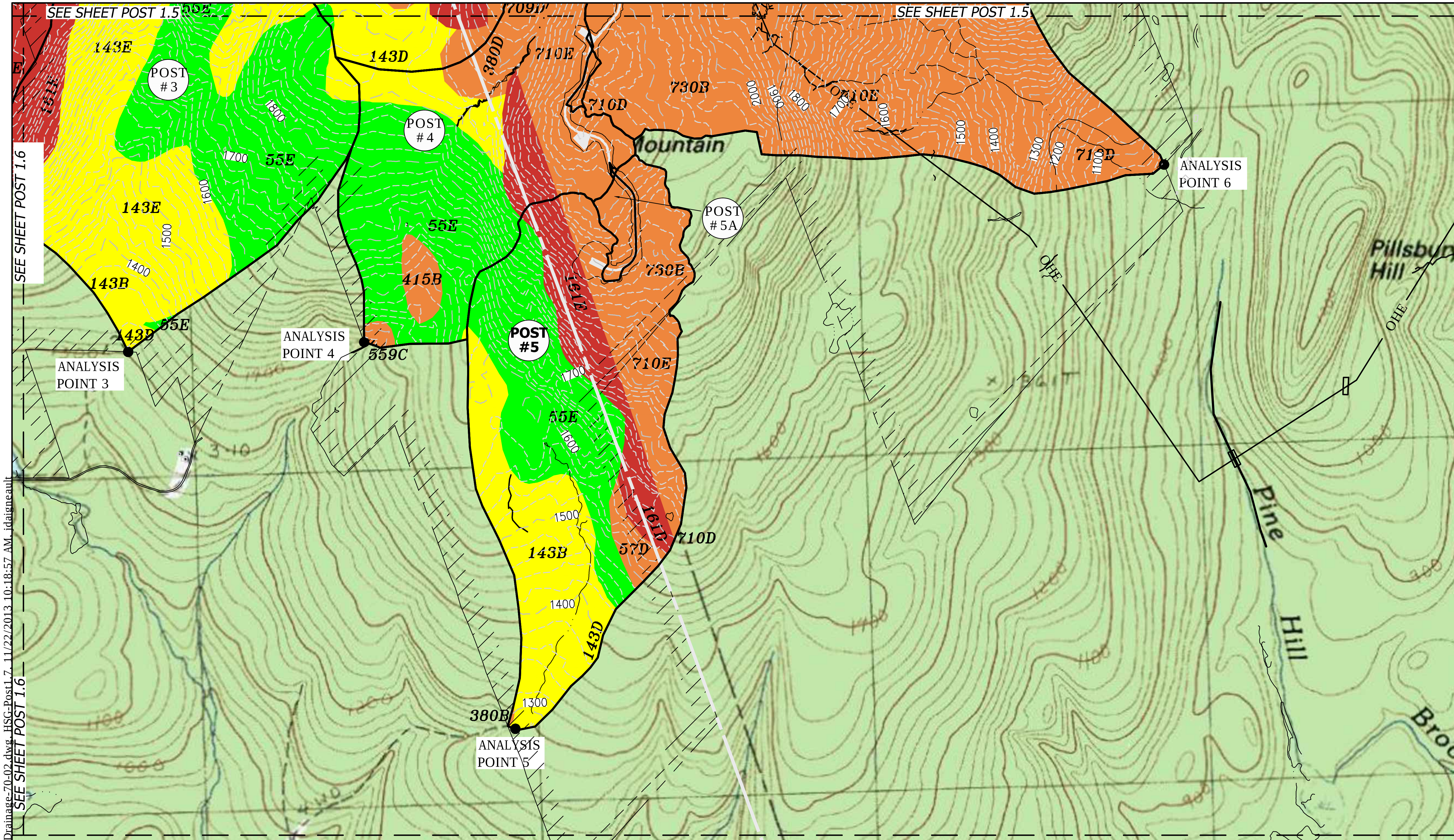
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

POST-DEVELOPMENT SOIL PLAN

SHEET POST 1.6



POST-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000

SCALE IN FEET

COLOR CODED SOIL PLANS SYMBOL KEY

HSG A	
HSG B	
HSG C	
HSG D	
IMPERVIOUS	
WATER	
PRE #1	SUBCATCHMENT LABEL
	SUBCATCHMENT BOUNDARY
	NRCS SOIL SERIES BOUNDARY
709D	NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)
	PROJECT LEASE AREA
	WETLAND OR STREAM

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED
PROFESSIONAL ENGINEER

11/21/13

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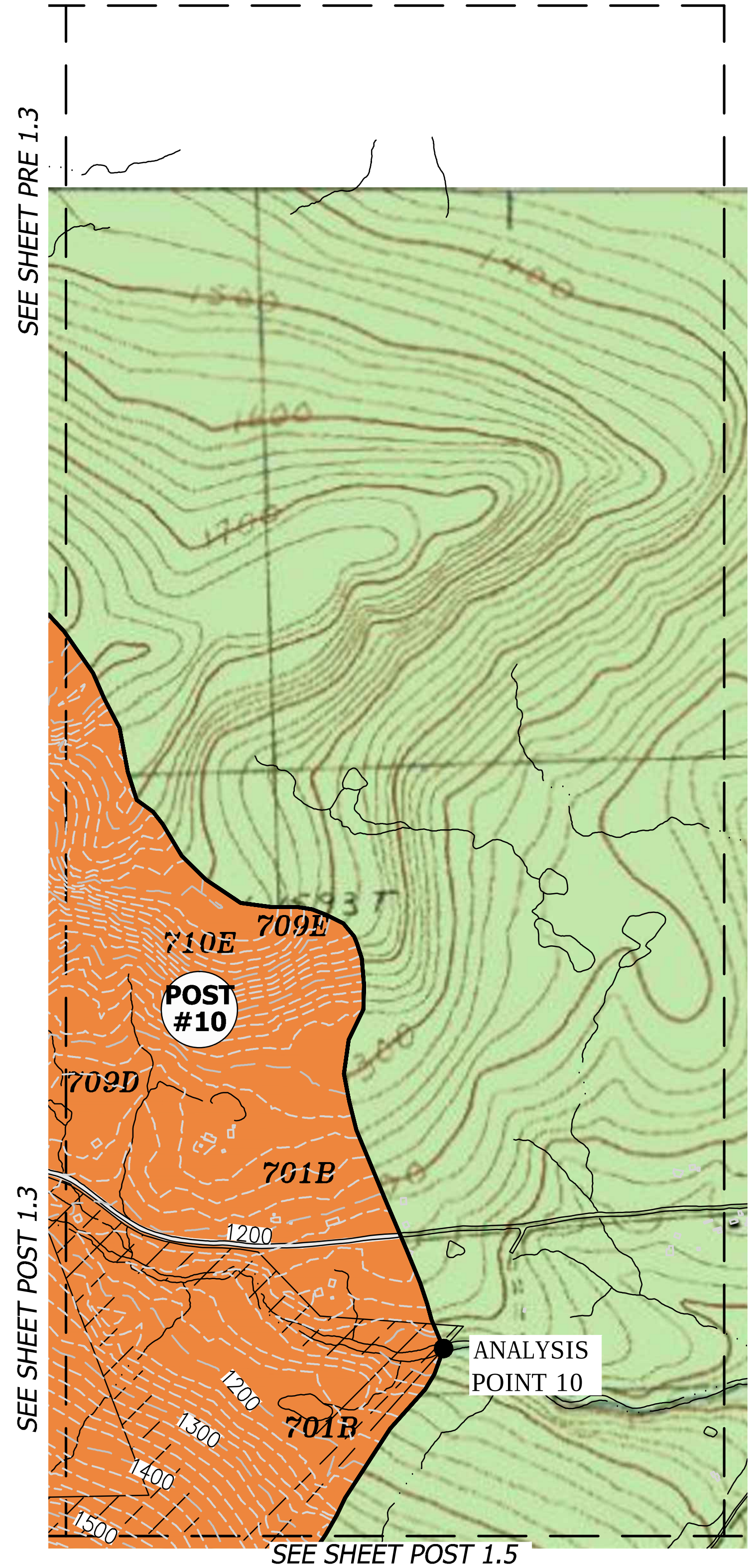
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

POST-DEVELOPMENT SOIL PLAN

SHEET POST 1.7



POST-DEVELOPMENT SOIL PLAN

0 500 1,000 2,000

SCALE IN FEET

STATE OF NEW HAMPSHIRE
ARTHUR
JOHN
COLVIN
No.13828
LICENSED
PROFESSIONAL ENGINEER

11/21/13

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER

PRE #1 SUBCATCHMENT LABEL

SUBCATCHMENT BOUNDARY

NRCS SOIL SERIES BOUNDARY

709D NRCS SOIL SERIES LABEL (SEE SHT. 2.2 FOR SOIL SERIES LEGEND)

PROJECT LEASE AREA

WETLAND OR STREAM

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

POST-DEVELOPMENT SOIL PLAN

SHEET POST 1.8

NRSC SOILS INFORMATION

MAPPING UNIT	SOIL TYPE(S)	HSG
36	ADAMS	A
61	TUNBRIDGE, LYMAN, ROCK	C/D
90	TUNBRIDGE, LYMAN	C/D
395	CHOCURUA MUCKY PEAT	D
710	BECHET, SKERRY	C

SITE-SPECIFIC SOILS INFORMATION

(USED WITHIN THE AREA OF PROPOSED DEVELOPMENT, AS DELINEATED BY RAYMOND LOBDELL, CSS.)

MAPPING UNIT	SOIL TYPE(S)	DRAINAGE CLASS	HSG
36C	ADAMS	EXCESSIVELY DRAINED	A
92B	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92C	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92D	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92E	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92F	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
99C	TUNBRIDGE VERY STONY	WELL DRAINED	C
99D	TUNBRIDGE VERY STONY	WELL DRAINED	C
169B	SUNAPEE VERY STONY	MODERATELY WELL DRAINED	B
299Bcaade	UDORTHENTS	WELL DRAINED	D
299Ccaade	UDORTHENTS	WELL DRAINED	D
299Dcabde	UDORTHENTS	WELL DRAINED	D
299Dcaade	UDORTHENTS	WELL DRAINED	D
350Bdaaab	UDORTHENTS	MODERATELY WELL DRAINED	B**
295A	GREENWOOD	VERY POORLY DRAINED	D
395A	GREENWOOD	VERY POORLY DRAINED	D
400Bbaabb	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	B**
400Bcbabb	UDORTHENTS	WELL DRAINED	B**
400Caaaaa	UDORTHENTS	EXCESSIVELY DRAINED	A**
400Cbaebc	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	C**
400Dbaabb	UDORTHENTS	EXCESSIVELY DRAINED	B
400Ebaabb	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	B**
400Fabaaa	UDORTHENTS	EXCESSIVELY DRAINED	A**
415B	MOOSILAUKE VERY STONY	POORLY DRAINED	C
500Cbaebc	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	C**
550Ccaebc	UDORTHENTS	WELL DRAINED	C
550Dbaded	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	D**
550Dbaabc	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	C**
699Aabaa	URBAN LAND	EXCESSIVELY DRAINED	A**
900Afaabc	DORTHENTS	POORLY DRAINED	C**

670 D

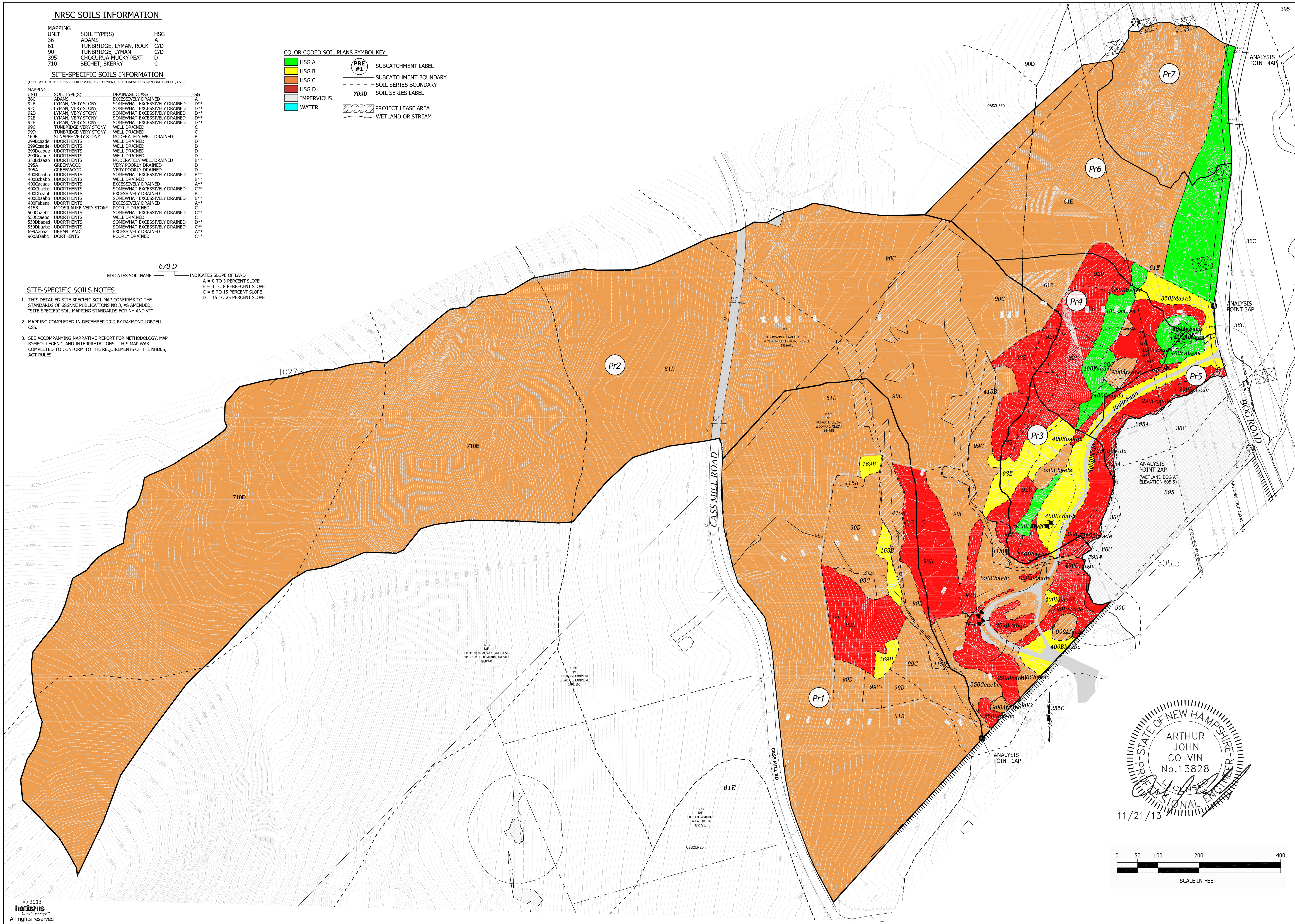
INDICATES SOIL NAME — 670

INDICATES SLOPE OF LAND — D

A = 0 TO 3 PERCENT SLOPE
B = 3 TO 8 PERRECENT SLOPE
C = 8 TO 15 PERCENT SLOPE
D = 15 TO 25 PERCENT SLOPE

SITE-SPECIFIC SOILS NOTES

1. THIS DETAILED SITE SPECIFIC SOIL MAP CONFIRMS TO THE STANDARDS OF SSSNNE PUBLICATIONS NO.3, AS AMENDED, "SITE-SPECIFIC SOIL MAPPING STANDARDS FOR NH AND VT"
2. MAPPING COMPLETED IN DECEMBER 2012 BY RAYMOND LOBDELL, CSS.
3. SEE ACCOMPANYING NARRATIVE REPORT FOR METHODOLOGY, MAP SYMBOL LEGEND, AND INTERPRETATIONS. THIS MAP WAS COMPLETED TO CONFORM TO THE REQUIREMENTS OF THE NHDES, AOT RULES.



STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED PROFESSIONAL ENGINEER
11/21/13

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: AJC
DRAWN BY:
CHECK'D BY: AJC
ARCHIVE #: H-5107

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34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: SUBSTATION AREA PRE-DEVELOPMENT SOIL PLAN

SHEET NUMBER: PRE 3.1

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NRSC SOILS INFORMATION

MAPPING UNIT	SOIL TYPE(S)	HSG
36	ADAMS	A
61	TUNBRIDGE, LYMAN, ROCK	C/D
90	TUNBRIDGE, LYMAN	C/D
395	CHOCURUA MUCKY PEAT	D
710	BECHET, SKERRY	C

SITE-SPECIFIC SOILS INFORMATION

(USED WITHIN THE AREA OF PROPOSED DEVELOPMENT, AS DELINEATED BY RAYMOND LOBDELL, CSS.)

MAPPING UNIT	SOIL TYPE(S)	DRAINAGE CLASS	HSG
36C	ADAMS	EXCESSIVELY DRAINED	A
92B	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92C	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92D	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92E	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
92F	LYMAN, VERY STONY	SOMEWHAT EXCESSIVELY DRAINED	D**
99C	TUNBRIDGE VERY STONY	WELL DRAINED	C
99D	TUNBRIDGE VERY STONY	WELL DRAINED	C
169B	SUNAPEE VERY STONY	MODERATELY WELL DRAINED	B
299Bcaade	UDORTHENTS	WELL DRAINED	D
299Ccaade	UDORTHENTS	WELL DRAINED	D
299Dcabde	UDORTHENTS	WELL DRAINED	D
299Dcaade	UDORTHENTS	WELL DRAINED	D
350Bdaaab	UDORTHENTS	MODERATELY WELL DRAINED	B**
295A	GREENWOOD	VERY POORLY DRAINED	D
395A	GREENWOOD	VERY POORLY DRAINED	D
400Bbaabb	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	B**
400Bcbabb	UDORTHENTS	WELL DRAINED	B**
400Caaaaa	UDORTHENTS	EXCESSIVELY DRAINED	A**
400Cbaebc	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	C**
400Dbaabb	UDORTHENTS	EXCESSIVELY DRAINED	B
400Ebaabb	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	B**
400Fabaaa	UDORTHENTS	EXCESSIVELY DRAINED	A**
415B	MOOSILAUKE VERY STONY	POORLY DRAINED	C
500Cbaebc	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	C**
550Ccaebc	UDORTHENTS	WELL DRAINED	C
550Dbaded	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	D**
550Dbaabc	UDORTHENTS	SOMEWHAT EXCESSIVELY DRAINED	C**
699Aabaa	URBAN LAND	EXCESSIVELY DRAINED	A**
900Afaabc	DORTHENTS	POORLY DRAINED	C**

670 D

INDICATES SOIL NAME

INDICATES SLOPE OF LAND
A = 0 TO 3 PERCENT SLOPE
B = 3 TO 8 PERRECENT SLOPE
C = 8 TO 15 PERCENT SLOPE
D = 15 TO 25 PERCENT SLOPE

SITE-SPECIFIC SOILS NOTES

1. THIS DETAILED SITE SPECIFIC SOIL MAP CONFIRMS TO THE STANDARDS OF SSSNNE PUBLICATIONS NO.3, AS AMENDED, "SITE-SPECIFIC SOIL MAPPING STANDARDS FOR NH AND VT"
2. MAPPING COMPLETED IN DECEMBER 2012 BY RAYMOND LOBDELL, CSS.
3. SEE ACCOMPANYING NARRATIVE REPORT FOR METHODOLOGY, MAP SYMBOL LEGEND, AND INTERPRETATIONS. THIS MAP WAS COMPLETED TO CONFORM TO THE REQUIREMENTS OF THE NHDES, AOT RULES.

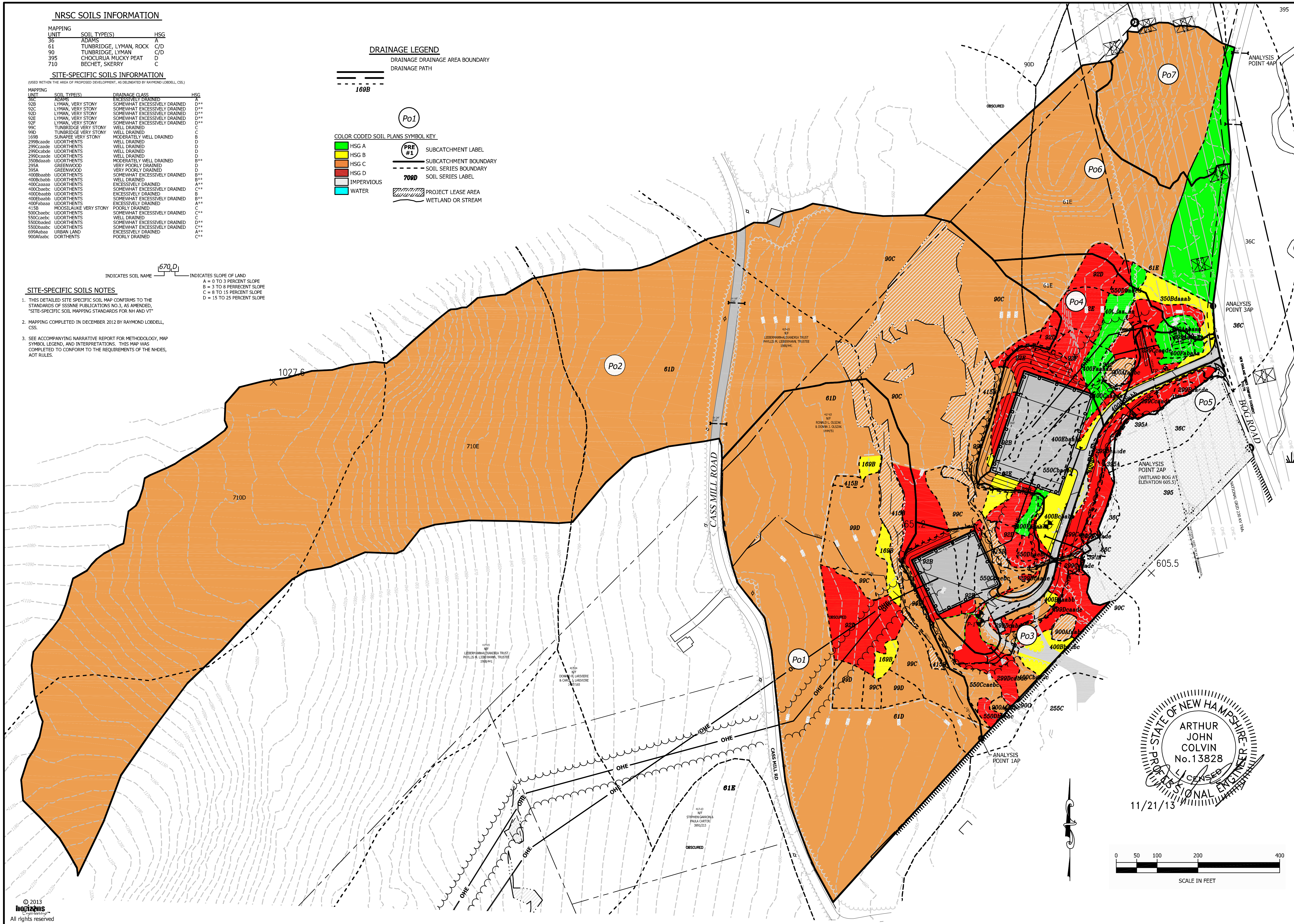
DRAINAGE LEGEND

DRAINAGE DRAINAGE AREA BOUNDARY
DRAINAGE PATH
169B

COLOR CODED SOIL PLANS SYMBOL KEY

HSG A
HSG B
HSG C
HSG D
IMPERVIOUS
WATER

PRE #1 SUBCATCHMENT LABEL
SUBCATCHMENT BOUNDARY
SOIL SERIES BOUNDARY
709D SOIL SERIES LABEL
PROJECT LEASE AREA
WETLAND OR STREAM



STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No.13828
LICENSED PROFESSIONAL ENGINEER
11/21/13

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: AJC
DRAWN BY:
CHECK'D BY: AJC
ARCHIVE #: H-5107

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34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: SUBSTATION AREA POST-DEVELOPMENT SOIL PLAN

SHEET NUMBER: POST 3.1

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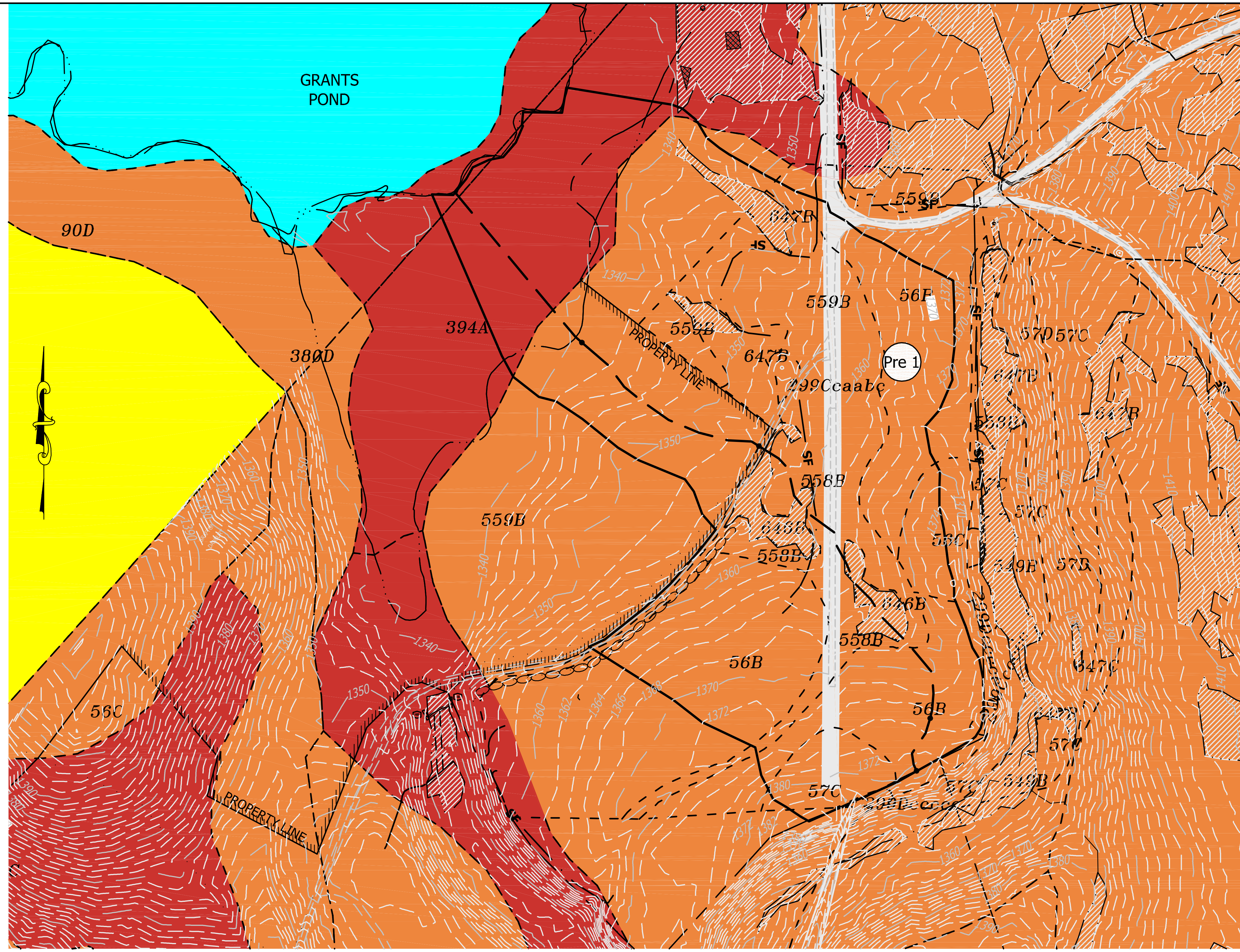

COLOR CODED SOIL PLANS SYMBOL KEY

- HSG A
- HSG B
- HSG C
- HSG D
- IMPERVIOUS
- WATER

- PRE #1 — SUBCATCHMENT LABEL
- SUBCATCHMENT BOUNDARY
- SOIL SERIES BOUNDARY
- *709D* — SITE SPECIFIC SOIL SERIES LABEL
- WETLAND OR STREAM

0 100 200 400

SCALE IN FEET

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ARTHUR
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No.13828
LICENSED
PROFESSIONAL ENGINEER
11/21/13

IBERDROLA
RENEWABLES

horizons Engineering inc
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Littleton, NH 03561
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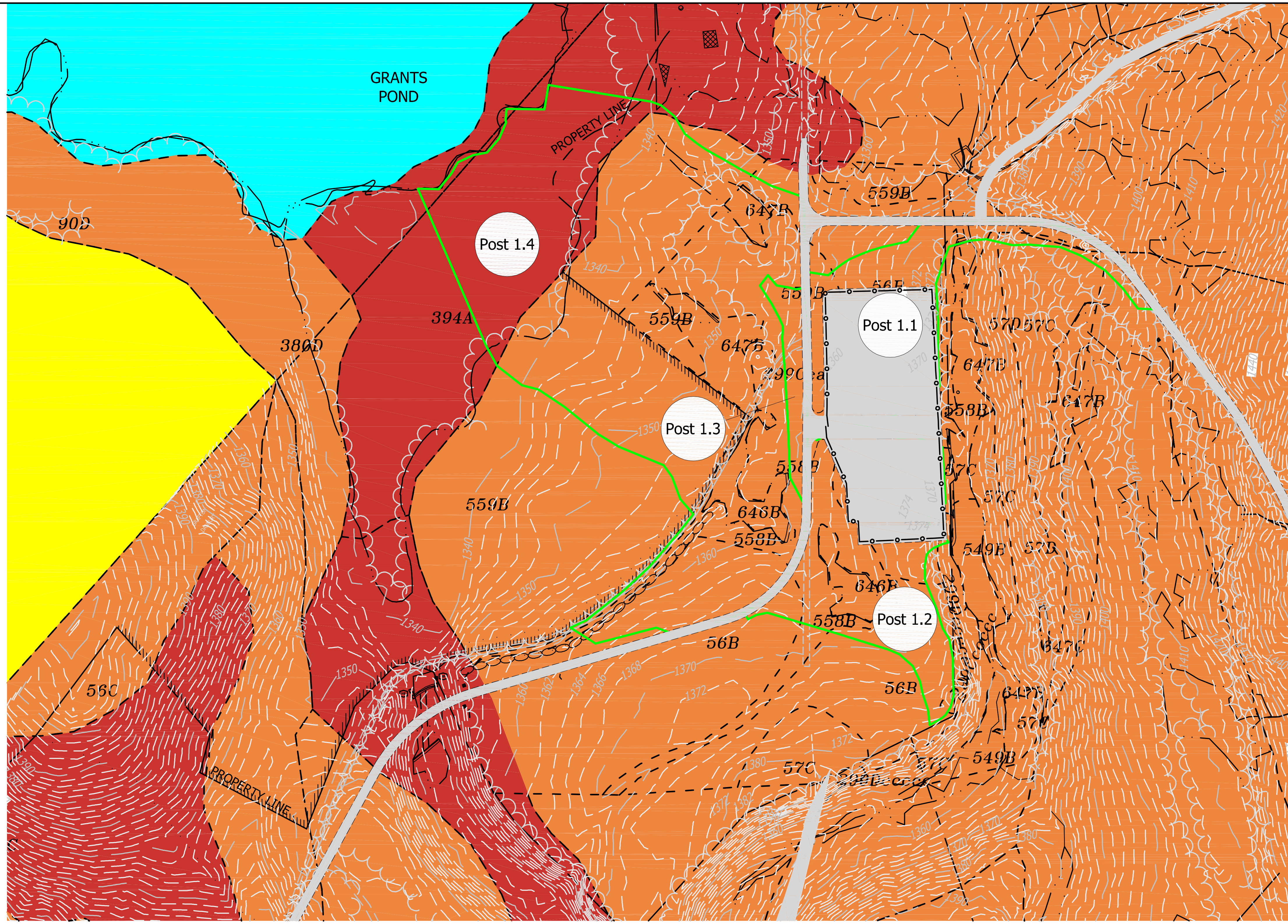
WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

OPERATIONS AND
MAINTENANCE FACILITY
PRE-DEVELOPMENT SOIL PLAN

SHEET: PRE 2.1



COLOR CODED SOIL PLANS SYMBOL KEY

HSG A	
HSG B	
HSG C	
HSG D	
IMPERVIOUS	
WATER	
PRE #1	SUBCATCHMENT LABEL
	SUBCATCHMENT BOUNDARY
	SOIL SERIES BOUNDARY
709D	SITE SPECIFIC SOIL SERIES LABEL
	WETLAND OR STREAM

0 100 200 400

SCALE IN FEET

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
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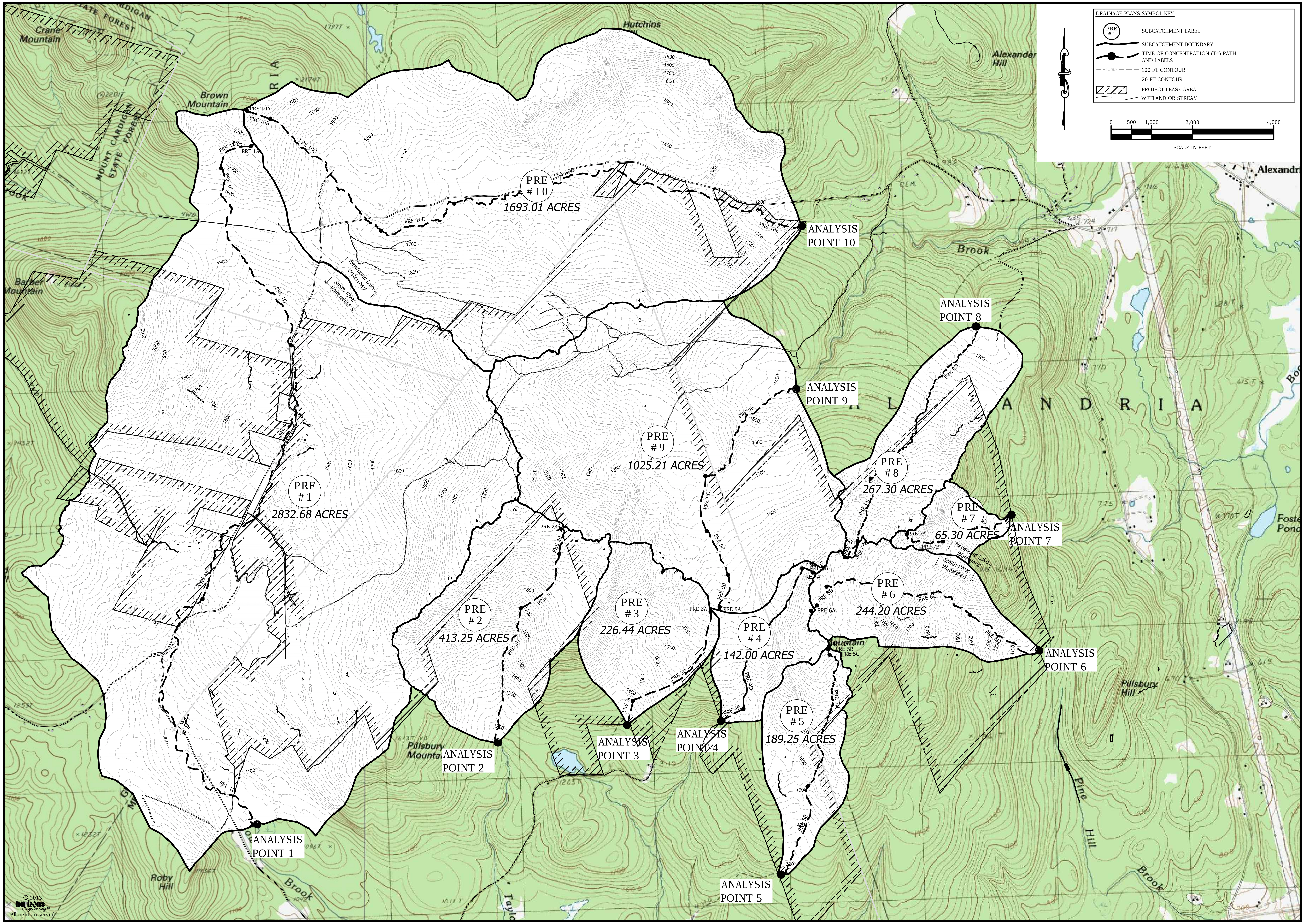
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

OPERATIONS AND MAINTENANCE FACILITY
POST-DEVELOPMENT SOIL PLAN

SHEET: POST 2.1

4.4 Pre- & Post-Development Drainage Area Plans

A. Overall Project
B. Substation Interconnection Station
C. Operation and Maintenance Building



IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 13, 2013
PROJECT #: 13185
ENGIN'D BY: AJC
DRAWN BY: MAH
CHECK'D BY: AJC
ARCHIVE #: H-5107

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11/21/13

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Littleton, NH 03561
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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
PRE-DEVELOPMENT DRAINAGE AREA PLAN

SHEET NUMBER: PRE 1.1

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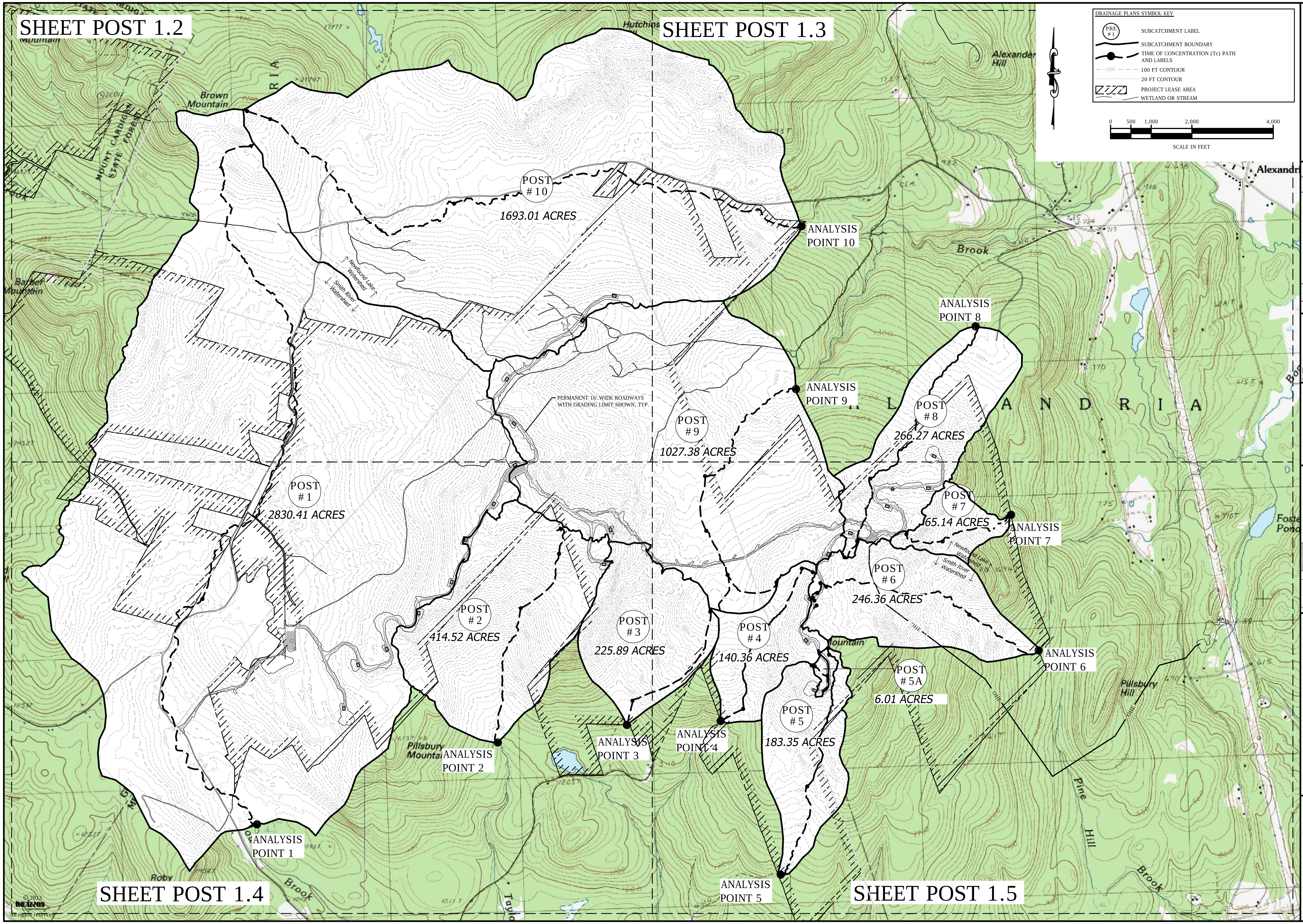

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

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PROJECT #: 13185
ENGIN'D BY: AJC
DRAWN BY: MAH
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 LICENSED PROFESSIONAL ENGINEER 12/3/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH
70 PERCENT DESIGN

SHEET TITLE: POST-DEVELOPMENT DRAINAGE AREA PLAN

SHEET NUMBER: POST 1.1

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DRAINAGE PLANS SYMBOL KEY

- PRE #1 — SUBCATCHMENT LABEL
- SUBCATCHMENT BOUNDARY
- TIME OF CONCENTRATION (Tc) PATH AND LABELS
- 100 FT CONTOUR
- 20 FT CONTOUR
- PROJECT LEASE AREA
- WETLAND OR STREAM

0 250 500 1,000 2,000

SCALE IN FEET

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 13, 2013
PROJECT #: 13185
ENGIN'D BY: AJC
DRAWN BY: MAH
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 LICENSED PROFESSIONAL ENGINEER
11/21/13

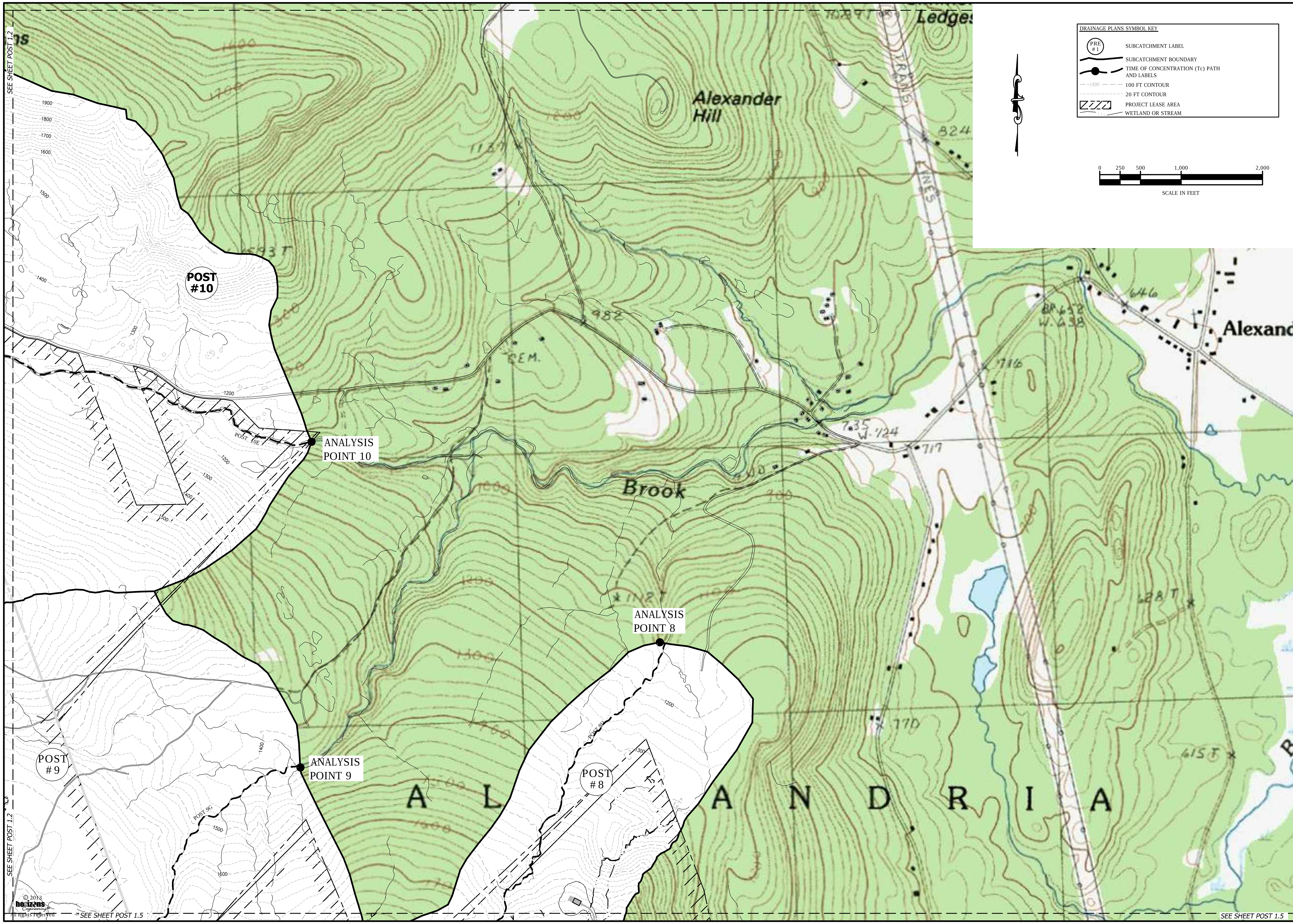
horizons Engineering Inc
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE: POST-DEVELOPMENT DRAINAGE AREA PLAN

SHEET NUMBER: POST 1.2



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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 13, 2013
PROJECT #: 13185
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ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE — ARTHUR JOHN COLVIN No. 13828 — PROFESSIONAL ENGINEER — 11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
POST-DEVELOPMENT DRAINAGE AREA PLAN

SHEET NUMBER: POST 1.3

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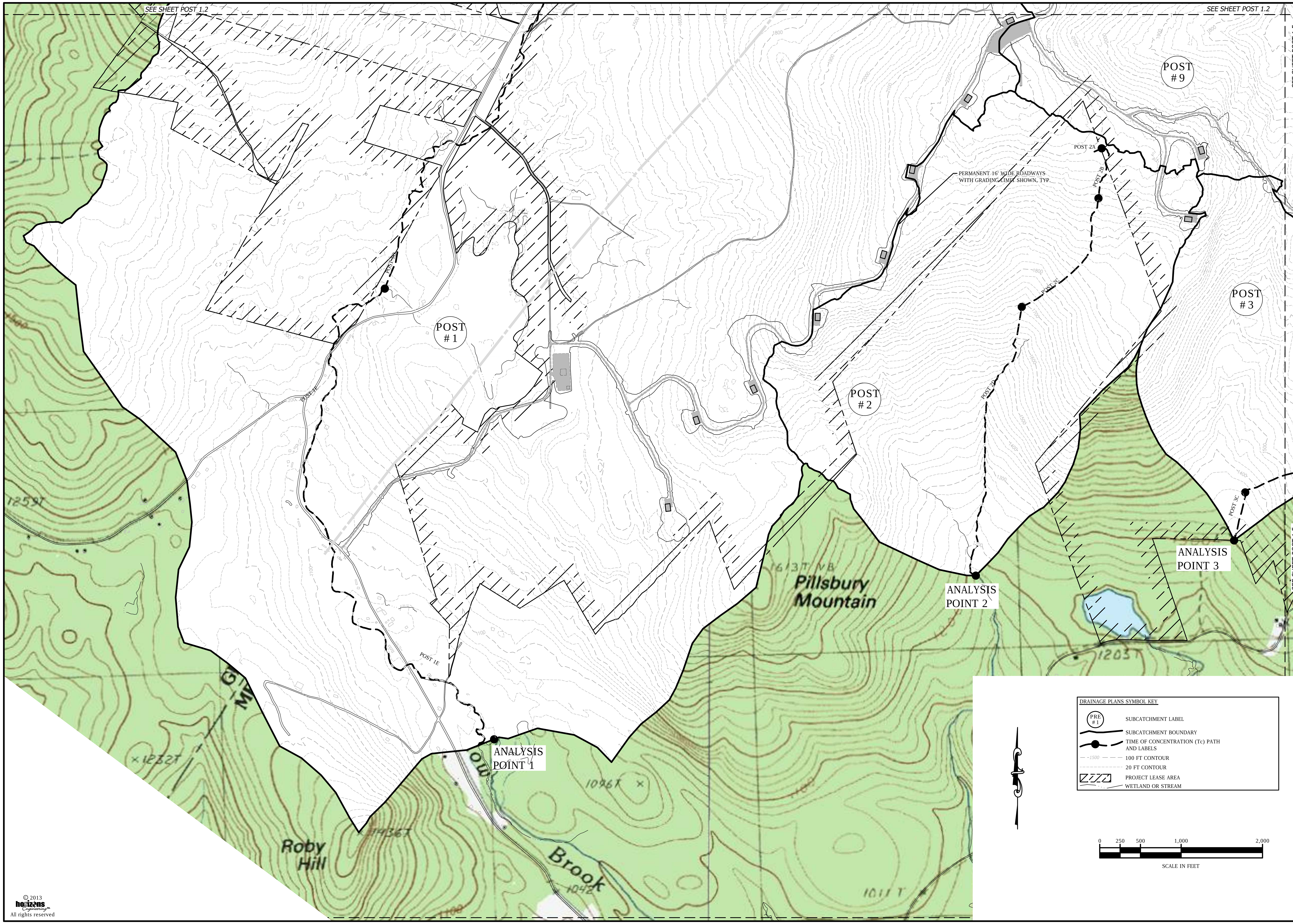

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 13, 2013
PROJECT #: 13185
ENGIN'D BY: AJC
DRAWN BY: MAH
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 LICENSED PROFESSIONAL ENGINEER 12/3/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
POST-DEVELOPMENT DRAINAGE AREA PLAN

SHEET NUMBER: POST 1.4

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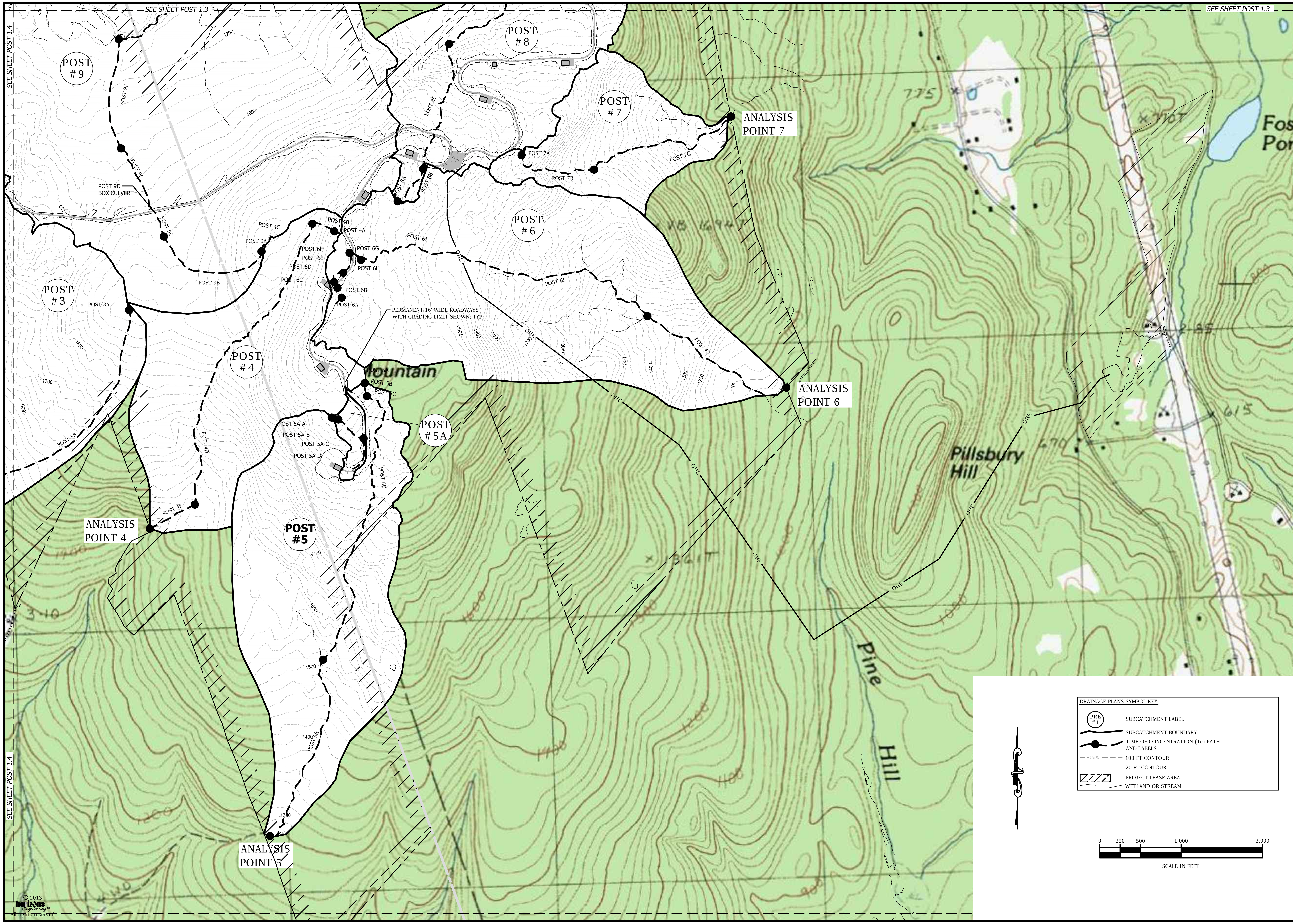

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 13, 2013
PROJECT #: 13185
ENGIN'D BY: AJC
DRAWN BY: MAH
CHECK'D BY: AJC
ARCHIVE #: H-5107

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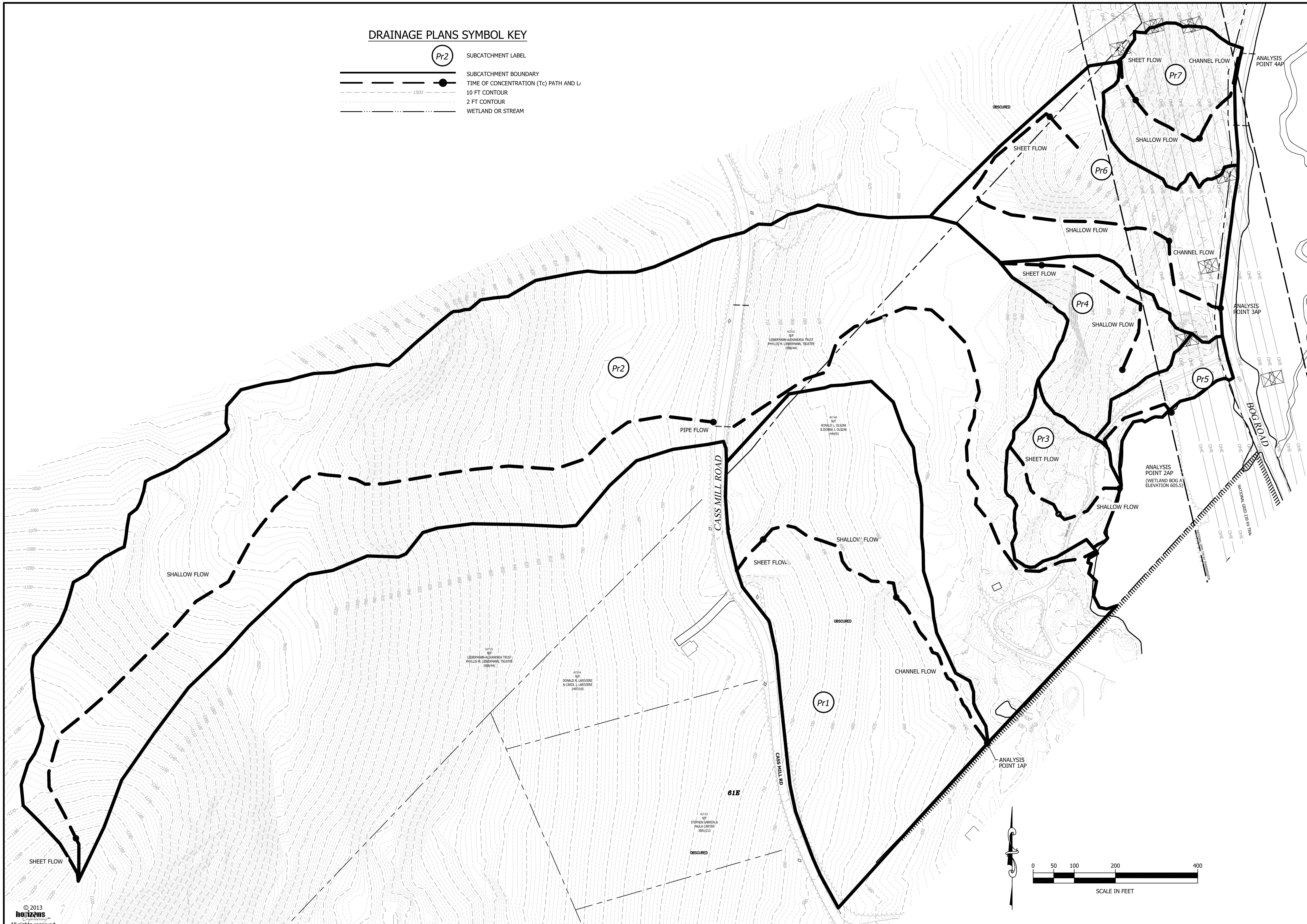
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH
70 PERCENT DESIGN

SHEET TITLE: POST-DEVELOPMENT DRAINAGE AREA PLAN

SHEET NUMBER: POST 1.5



IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: DEB
DRAWN BY: DEB
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE — ARTHUR JOHN COLVIN — No. 13828 — PROFESSIONAL ENGINEER — 11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
SUBSTATION AREA
PRE-DEVELOPMENT
DRAINAGE ANALYSIS

SHEET NUMBER: PRE 3.1

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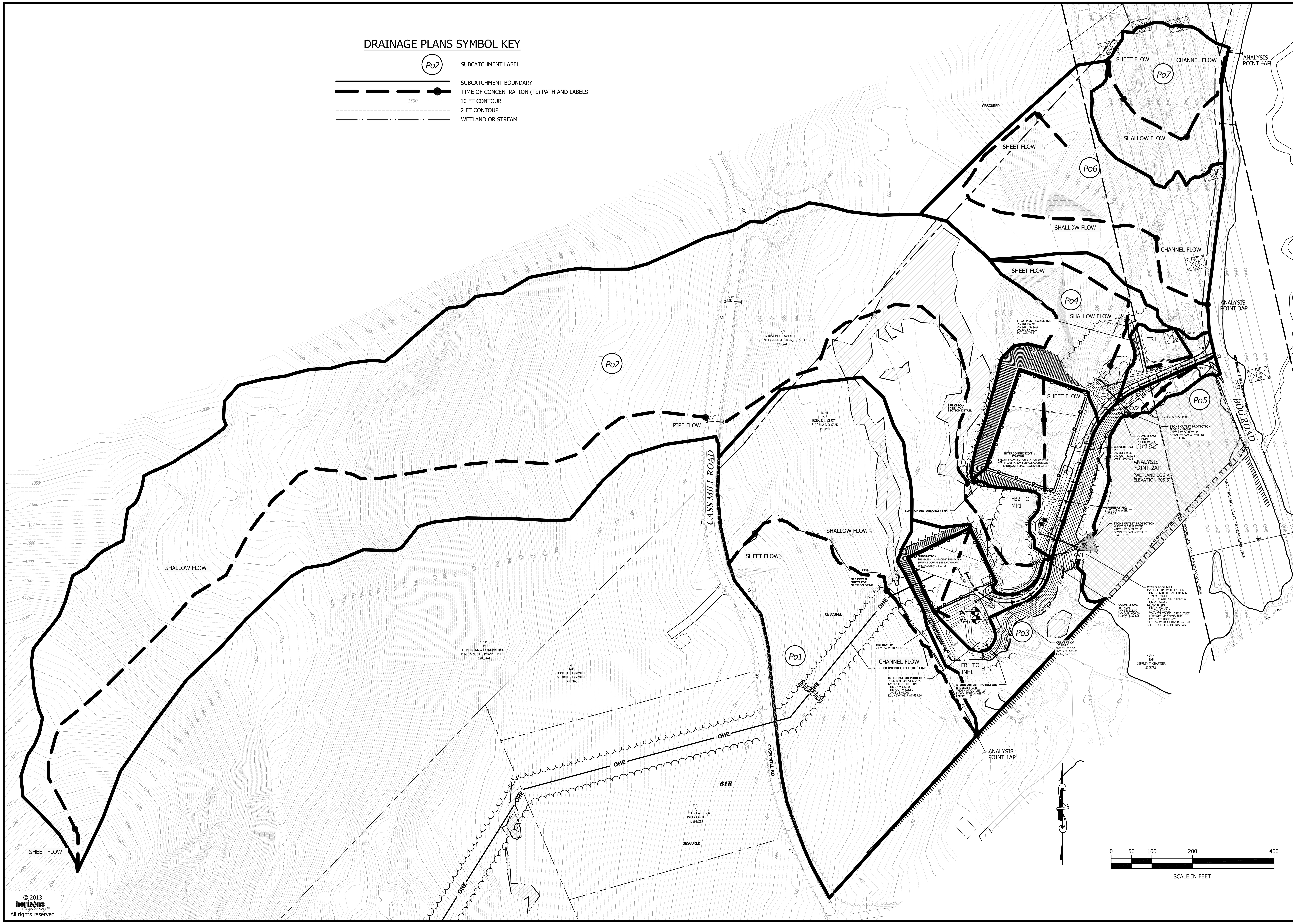

WILD MEADOWS WIND PROJECT

ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: AJC
DRAWN BY:
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE
ARTHUR JOHN COLVIN
No. 13828
PROFESSIONAL ENGINEER
11/21/13

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Phone 603.444.4111 - Fax 603.444.1343

SHEET TITLE: SUBSTATION AREA POST-DEVELOPMENT DRAINAGE ANALYSIS

SHEET NUMBER: POST 3.1

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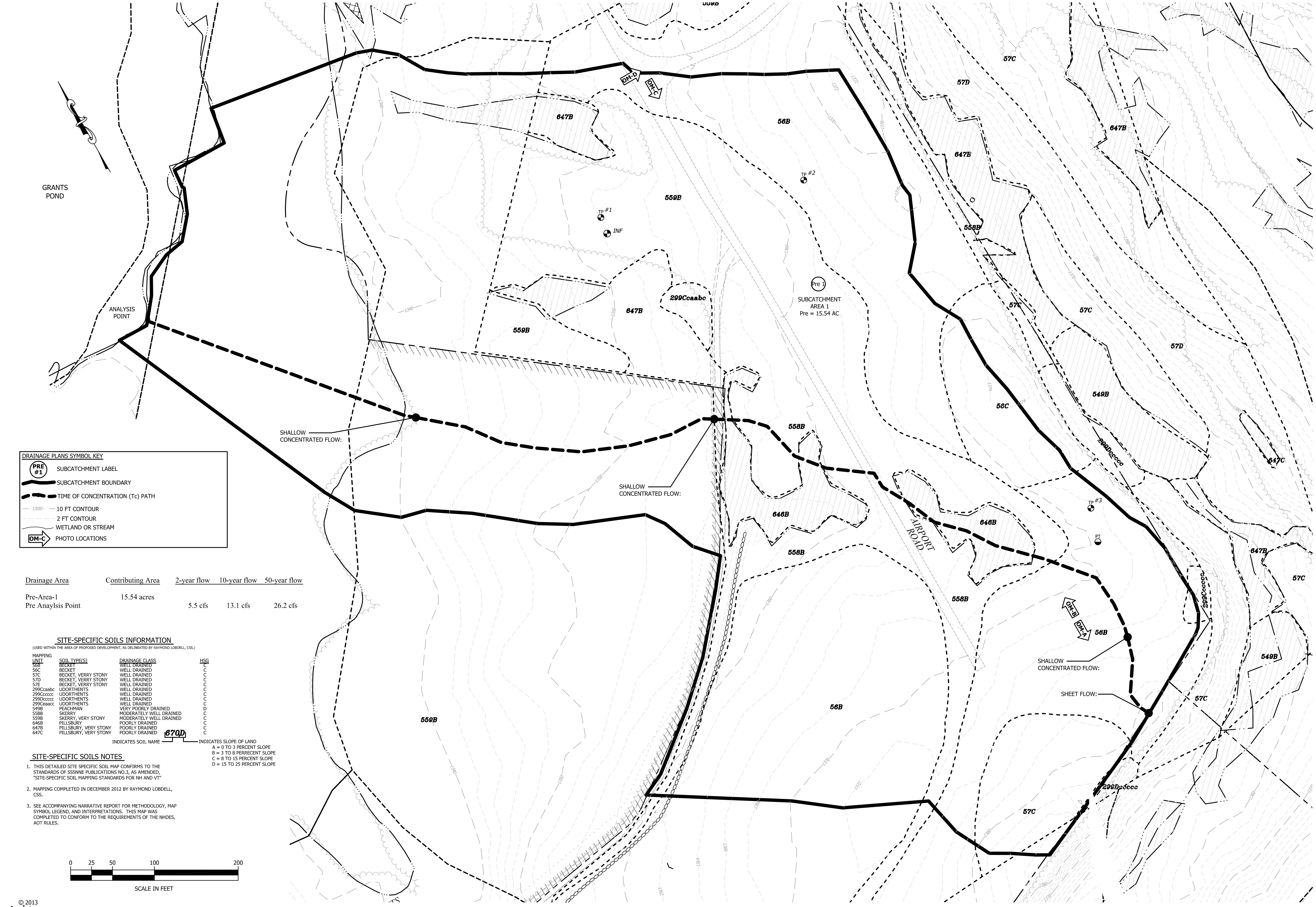

DRAINAGE PLANS SYMBOL KEY

- PRE #1 — SUBCATCHMENT LABEL
- SUBCATCHMENT BOUNDARY
- TIME OF CONCENTRATION (Tc) PATH
- 1500 — 10 FT CONTOUR
- 2 FT CONTOUR
- WETLAND OR STREAM
- OM-C — PHOTO LOCATIONS

Drainage Area	Contributing Area	2-year flow	10-year flow	50-year flow
Pre-Area-1	15.54 acres			
Pre Anaylsis Point		5.5 cfs	13.1 cfs	26.2 cfs

SITE-SPECIFIC SOILS INFORMATION

(USED WITHIN THE AREA OF PROPOSED DEVELOPMENT, AS DELINEATED BY RAYMOND LOBDELL, CSS.)

MAPPING UNIT	SOIL TYPE(S)	DRAINAGE CLASS	HSG
56B	BECKET	WELL DRAINED	C
56C	BECKET	WELL DRAINED	C
57C	BECKET, VERRY STONY	WELL DRAINED	C
57D	BECKET, VERRY STONY	WELL DRAINED	C
57E	BECKET, VERRY STONY	WELL DRAINED	C
299Ccaabc	UDORTHENTS	WELL DRAINED	C
299Cccccc	UDORTHENTS	WELL DRAINED	C
299Dccccc	UDORTHENTS	WELL DRAINED	C
299Ceaacc	UDORTHENTS	WELL DRAINED	C
549B	PEACHMAN	VERY POORLY DRAINED	D
558B	SKERRY	MODERATELY WELL DRAINED	C
559B	SKERRY, VERY STONY	MODERATELY WELL DRAINED	C
646B	PILLSBURY	POORLY DRAINED	C
647B	PILLSBURY, VERY STONY	POORLY DRAINED	C
647C	PILLSBURY, VERY STONY	POORLY DRAINED	C

670D

INDICATES SOIL NAME — INDICATES SLOPE OF LAND

A = 0 TO 3 PERCENT SLOPE
B = 3 TO 8 PERRECENT SLOPE
C = 8 TO 15 PERCENT SLOPE
D = 15 TO 25 PERCENT SLOPE

SITE-SPECIFIC SOILS NOTES

1. THIS DETAILED SITE SPECIFIC SOIL MAP CONFIRMS TO THE STANDARDS OF SSSNNE PUBLICATIONS NO.3, AS AMENDED, "SITE-SPECIFIC SOIL MAPPING STANDARDS FOR NH AND VT"
2. MAPPING COMPLETED IN DECEMBER 2012 BY RAYMOND LOBDELL, CSS.
3. SEE ACCOMPANYING NARRATIVE REPORT FOR METHODOLOGY, MAP SYMBOL LEGEND, AND INTERPRETATIONS. THIS MAP WAS COMPLETED TO CONFORM TO THE REQUIREMENTS OF THE NHDES, AOT RULES.

0 25 50 100 200

SCALE IN FEET

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE:	NOVEMBER 2013
PROJECT #:	13185
ENGIN'D BY:	JCD
DRAWN BY:	JCD
CHECK'D BY:	AJC
ARCHIVE #:	H-5107

STATE OF NEW HAMPSHIRE - ARTHUR JOHN COLVIN No.13828 LICENSED - PROFESSIONAL ENGINEER
11/21/13

horizons Engineering Inc
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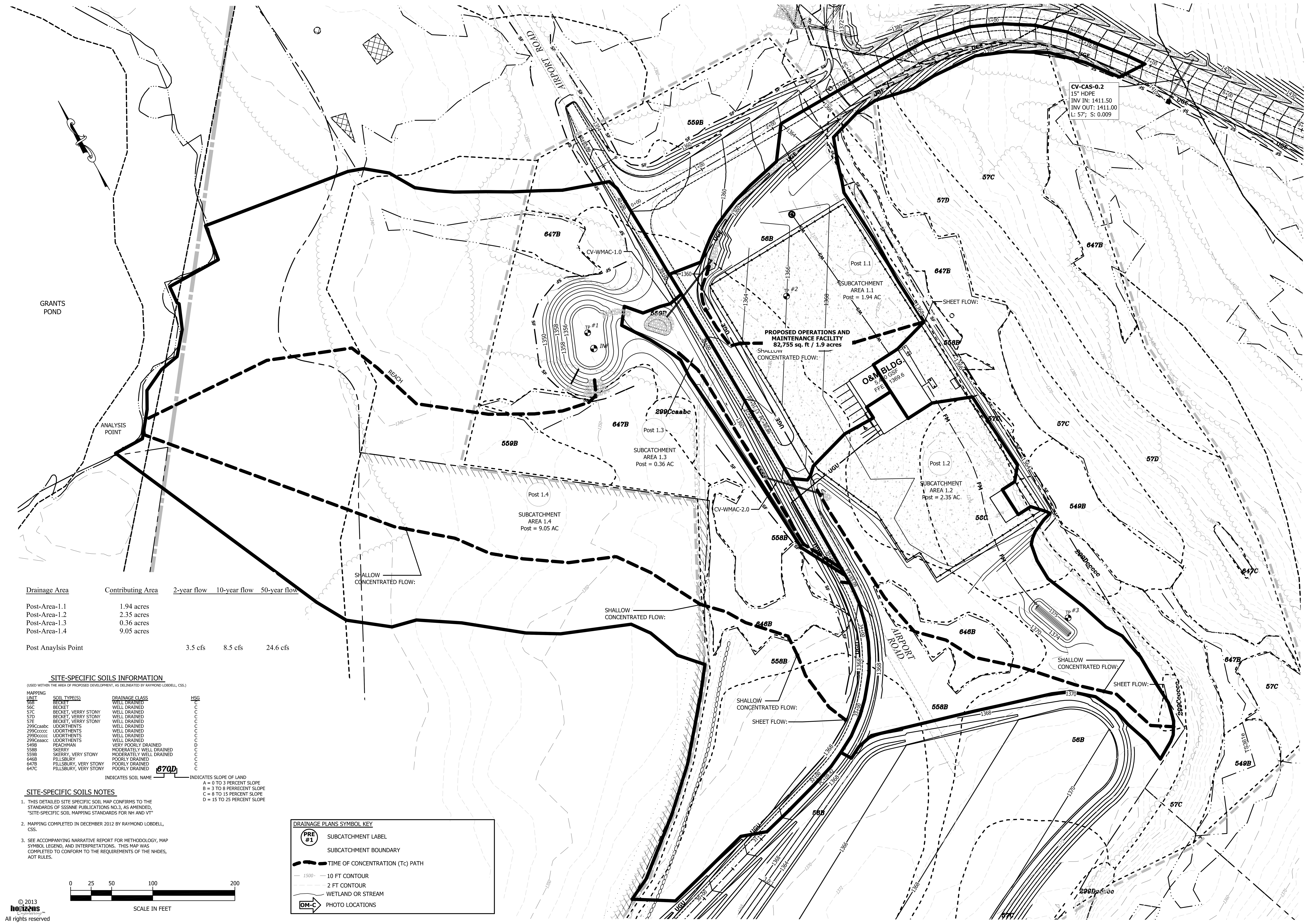
WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
OPERATIONS AND MAINTENANCE FACILITY PRE-DEVELOPMENT DRAINAGE ANYALYSIS

SHEET NUMBER: PRE 2.1



Drainage Area	Contributing Area	2-year flow	10-year flow	50-year flow
Post-Area-1.1	1.94 acres			
Post-Area-1.2	2.35 acres			
Post-Area-1.3	0.36 acres			
Post-Area-1.4	9.05 acres			
Post Anaylsis Point		3.5 cfs	8.5 cfs	24.6 cfs

SITE-SPECIFIC SOILS INFORMATION

(USED WITHIN THE AREA OF PROPOSED DEVELOPMENT, AS DELINEATED BY RAYMOND LOBDELL, CSS.)

MAPPING UNIT	SOIL TYPE(S)	DRAINAGE CLASS	HSG
56B	BECKET	WELL DRAINED	C
56C	BECKET	WELL DRAINED	C
57C	BECKET, VERRY STONY	WELL DRAINED	C
57D	BECKET, VERRY STONY	WELL DRAINED	C
57E	BECKET, VERRY STONY	WELL DRAINED	C
299Ccaabc	UDORTHENTS	WELL DRAINED	C
299Cccccc	UDORTHENTS	WELL DRAINED	C
299Dccccc	UDORTHENTS	WELL DRAINED	C
299Ceaacc	UDORTHENTS	WELL DRAINED	C
549B	PEACHMAN	VERY POORLY DRAINED	D
558B	SKERRY	MODERATELY WELL DRAINED	C
559B	SKERRY, VERY STONY	MODERATELY WELL DRAINED	C
646B	PILLSBURY	POORLY DRAINED	C
647B	PILLSBURY, VERY STONY	POORLY DRAINED	C
647C	PILLSBURY, VERY STONY	POORLY DRAINED	C

670D
INDICATES SOIL NAME
INDICATES SLOPE OF LAND
A = 0 TO 3 PERCENT SLOPE
B = 3 TO 8 PERRECENT SLOPE
C = 8 TO 15 PERCENT SLOPE
D = 15 TO 25 PERCENT SLOPE

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1. THIS DETAILED SITE SPECIFIC SOIL MAP CONFIRMS TO THE STANDARDS OF SSSNNE PUBLICATIONS NO.3, AS AMENDED, "SITE-SPECIFIC SOIL MAPPING STANDARDS FOR NH AND VT"
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3. SEE ACCOMPANYING NARRATIVE REPORT FOR METHODOLOGY, MAP SYMBOL LEGEND, AND INTERPRETATIONS. THIS MAP WAS COMPLETED TO CONFORM TO THE REQUIREMENTS OF THE NHDES, AOT RULES.

DRAINAGE PLANS SYMBOL KEY

PRE #1 SUBCATCHMENT LABEL
SUBCATCHMENT BOUNDARY
TIME OF CONCENTRATION (Tc) PATH
1500 10 FT CONTOUR
2 FT CONTOUR
WETLAND OR STREAM
OM-C PHOTO LOCATIONS

0 25 50 100 200
SCALE IN FEET

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IBERDROLA RENEWABLES

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: NOVEMBER 2013
PROJECT #: 13185
ENGIN'D BY: JCD
DRAWN BY: JCD
CHECK'D BY: AJC
ARCHIVE #: H-5107

STATE OF NEW HAMPSHIRE ARTHUR JOHN COLVIN No. 13828 LICENSED PROFESSIONAL ENGINEER 11/21/13

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WILD MEADOWS WIND PROJECT
ALEXANDRIA AND DANBURY, NH

70 PERCENT DESIGN

SHEET TITLE:
OPERATIONS AND MAINTENANCE FACILITY POST-DEVELOPMENT DRAINAGE AREA PLAN

SHEET NUMBER: POST 2.1

SECTION 5.0 100 YEAR FLOODPLAIN REPORT – N/A

WAIVER REQUESTS

Project No. 13185
November 21, 2013

NH Department of Environmental Services
Wetlands Bureau
29 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03302-0095

SUBJECT: NHDES Waiver Request – Iberdrola Renewables -Wild Meadows Wind Project

To Whom It May Concern;

Horizons Engineering, Inc. (Agent) is hereby submitting a waiver request on behalf of Atlantic Wind, LLC (Applicant) for the construction of a commercial wind powered electrical generation facility on the following lots located in Danbury and Alexandria, NH:

417-43	Ronald L & Donna J. Olszak
417-13	Stephen Garron & Paula Carter
417-8	Mike Corliss
417-4	Nelson R. Shaller
414-144	Michael B. Oeschger
415-5	H. & H. INVESTMENTS, LLC.
403-25	H. & H. INVESTMENTS, LLC.
403-20	H. & H. INVESTMENTS, LLC.
403-19	H. & H. INVESTMENTS, LLC.
403-18	H. & H. INVESTMENTS, LLC.
401-1	H. & H. INVESTMENTS, LLC.
403-9	Monique Jome Ricker & Michelle Jome

The waiver request is being submitted pursuant to Env-Wq 1509.02. The rule to which we are requesting the waiver, for portions of the project, is Env-Wq 1504.09(e), and 1504.09(e)(3) and 1504.09(g)(3).

Agent Information:
Art Colvin, P.E.
Senior Project Manager
Horizons Engineering, Inc.
34 School St.
Littleton, NH 03561
603-444-4111
acolvin@horizonsengineering.com

Applicant Information:
Erik Lallum
VP Engineering & Construction
Atlantic Wind LLC
1125 NW Couch Street, Suite 700
Portland, OR 97209
(503) 478-6361

Alteration of Terrain (AoT) Rules indicate that Pre- and Post-development drainage area plans be provided at a scale of 1 inch = 50 feet and that elevation contours are shown at 2 foot contours. Because of the scale of the project and associated analysis point drainage areas which comprise over 7,000 acres, submitting plans at these scales and contour intervals would require DES to paste together many sheets, thus making it unwieldy to review, and perhaps, lose some of the insight into the interrelated nature of certain project features that might be lost at sheet or drainage area margins. The present application provides pre-development drainage area plans at a scale of 1 inch = 1,000 feet and contour intervals of 20 feet. The post-development drainage area plans are provided at a scale of 1 inch = 500 feet and contour intervals of 20 feet showing the project on four 11 inch x 17 inch plan sheets. An overview index sheet for these post-development plans has been provided as well.

The pre and post development drainage areas plans for the substation (titled *Substation Area P-re-Development Drainage Analysis* shown on Sheet Pre 3.1 and the *Substation Area Post-Development Drainage Analysis* shown on Sheet Post 3.1) have been provided at a scale of 1 inch = 100 feet. This enables the proposed work and analysis to be shown on one sheet and may better facilitate DES review.

Should DES have specific questions for which a more detailed plan scale and contour interval would help address, we would be happy to provide those on a case by case basis as requested by DES, but at present, we do not see that providing plans at the scale specified in AoT would cause adverse impact on the environment, nor would it provide benefit to the public or environment.

Color coded soils plans have been provided for all areas of the project site, however, despite differences in sources of hydrologic soil groups, we have provided all soils in the colors specified in 1504.09(g)(2) to aid in review of soil types rather than the source of such data. Taken together with the waiver request for site specific soils, we feel that this consistency in color coding will only aid in review and will not harm the environment, nor would strict adherence to the rule provide benefit to the public or environment.

The AoT checklist indicates that soil plans be provided at 2 foot contour intervals, while not specified in the AoT Rules, we ask for this waiver, to the extent needed, for the same reasons stated for the contour interval at the beginning of this waiver request.

We therefore ask that the waiver be granted for the above referenced waivers and trust that you find the reasoning for such waivers as acceptable and helpful in your review.

Respectfully,

Art Colvin, P.E.
Project Manager
Horizons Engineering, Inc.

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horizons Engineering Inc.

34 SCHOOL STREET • LITTLETON, NH 03561 • PHONE 603-444-4111 • FAX 603-444-1343 • www.horizonsengineering.com

Project No. 13185
November 21, 2013

NH Department of Environmental Services
Wetlands Bureau
29 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03302-0095

SUBJECT: NHDES Waiver Request – Iberdrola Renewables -Wild Meadows Wind Project

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403-25	H. & H. INVESTMENTS, LLC.
403-20	H. & H. INVESTMENTS, LLC.
403-19	H. & H. INVESTMENTS, LLC.
403-18	H. & H. INVESTMENTS, LLC.
401-1	H. & H. INVESTMENTS, LLC.
403-9	Monique Jome Ricker & Michelle Jome

The waiver request is being submitted pursuant to Env-Wq 1509.02. The rule to which we are requesting the waiver is Env-Wq 1508.19(b)-(h).

Agent Information:
Art Colvin, P.E.
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Applicant Information:
Erik Lallum
VP Engineering & Construction
Atlantic Wind LLC
1125 NW Couch Street, Suite 700
Portland, OR 97209
(503) 478-6361

This project proposes the construction of a number of slopes that will exceed the vertical height in which diversions or benching are required by Env-Wq 1508. The number, height, and length of slopes have been kept low by designing roads with steeper grades and incurring the added construction cost of requiring the use of construction delivery vehicles and equipment that can travel these steeper roads. The project design has purposely followed an approach to disperse drainage rather than concentrate it and has not directed concentrated flow to these slopes. Consistent with this dispersed design, a formal diversion ditch at the top of slopes is not specified.

Many of these slopes will be constructed and surfaced with rock that has been blasted and/or excavated at the site, however, others will contain a mixture of rock and earth that have been mass excavated from the site and used to construct fill slopes. Although it appears that Env-Wq 1508 applies to earthen slopes only, this waiver request is being submitted to proactively describe how slopes that contain varying percentages of earth and rock (but are predominantly earth) will be constructed to be equally or more stable than those with benching.

- A geotechnical report prepared as part of the project design has set forth material specifications that are to be used in constructing stable cut and fill slopes at various angles. These specifications allow for steeper roads that provide an environmental benefit of a smaller overall footprint of earth disturbance.

- Large slopes that have earth in them typically contain greater than 50% rock at their surface which retards erosion, and the remaining portion surface is vegetated, which reduces slope erosion and can reduce slope saturation.

- Adding benches would further extend the footprint of disturbance a minimum of 10% for each 2:1 slope on which benches are incorporated. On the steeper terrain of this project this percentage of increase in footprint can be considerably greater than 10% with benches where the ends of the constructed slope "chase" an existing grade to find a point where the native and constructed grades will meet.

- Most runoff from crowned roadways or turbine pads, where substantial slopes exist, must first shed across a grass strip alongside the road or pad and then either enter a stone lined ditch to be conveyed to the bottom of a slope in a pipe, or reach the top of a fill slope as sheet flow. Consistent with the overall design approach of having dispersed drainage, it would be counter-productive to intercept dispersed runoff on the slope and route it across the slope in a bench as this concentrated flow would now require further disturbance to create a stable bench outlet point.

- All earthen slopes steeper than 3:1, and with a slope length of 20 feet or greater, will have seed and erosion control matting or stumpgrindings applied. Such slopes have proven stable on other similar projects. If instability is to occur it often appears during construction and the combination of frequent erosion control monitoring and availability of construction equipment and materials allows for the focused analysis of the source of problem and a site specific solution that may better address the problem when compared to showing benches on plans at specified intervals months before ground is broken.

In summary, the project has used data and incorporated features within its design to prevent slope instability without the need for benches. Adding benches at generalized intervals specified in Rule does not appear to provide any greater level of slope stability than the measures proposed and will certainly result in a greater environmental disturbance with no apparent benefit to the public.

Respectfully,

Art Colvin, P.E.
Project Manager
Horizons Engineering, Inc.

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Project No. 13185
November 21, 2013

NH Department of Environmental Services
Wetlands Bureau
29 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03302-0095

SUBJECT: NHDES Waiver Request – Iberdrola Renewables -Wild Meadows Wind Project

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403-19	H. & H. INVESTMENTS, LLC.
403-18	H. & H. INVESTMENTS, LLC.
401-1	H. & H. INVESTMENTS, LLC.
403-9	Monique Jome Ricker & Michelle Jome

The waiver request is being submitted pursuant to Env-Wq 1509.02. The rule to which we are requesting the waiver for portions of the project is Env-Wq 1507.03(e).

Agent Information:
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603-444-4111
acolvin@horizonsengineering.com

Applicant Information:
Erik Lallum
VP Engineering & Construction
Atlantic Wind LLC
1125 NW Couch Street, Suite 700
Portland, OR 97209
(503) 478-6361

Stormwater runoff from impervious surfaces can contain a wide range of non-point source pollutants. Depending on the activity and use of the impervious surface, these pollutants might include sediments, metals, nutrients, oils and greases, temperature, chlorides, bacteria, pH, and others. The Alteration of Terrain (AoT) stormwater treatment standards are intended to ensure that stormwater runoff that may contain many of these potential pollutants are captured and treated to remove the pollutants. The concentration of certain pollutants found in stormwater running off of paved roadways often correlates positively to the intensity of use (a higher number of vehicles trips per day generates a higher load of pollutants). In this wind project, once construction is completed, the roadways will only constitute 1.4% of the analysis point drainage area within the most developed watershed and the amount of traffic on the roadways and pads, project wide, is anticipated to be extremely low and, therefore, we anticipate few if any vehicular related pollutants to be present in the runoff from these roadways and pads. Instead, it is anticipated that the primary potential pollutants that might be found in stormwater running off of the roadways and pads are sediments (Tss), as well as some potential for increasing the temperature of runoff due to the removal of trees that would otherwise shade these surfaces, changing albedo, and the mass of the rock that surfaces the roadways and pads.

This project proposes the construction of a number of roadways and wind turbine pads with a gravelly surface that will be used to facilitate the construction and erection of wind turbines. After construction is complete a portion of these surfaces will be covered by organic material and vegetated with grasses, leaving a 16' wide road and a reduction in the footprint of gravelly wind turbine pad. This reduction of gravelly surface has a dual advantage of minimizing the impervious surface that can generate runoff as well as providing a grass buffer through which runoff enters and coarse sediment particles are settled. On steeper roadways (over 7.5%) where a 40 foot wide construction road is reduced to 16 feet, the flow length of runoff through grass buffers meets roadway buffer standards. On flatter and narrower roadways, treatment swales have been proposed, and they meet treatment swale standards. At the O&M facility and the substation, the proposed treatment swale, sand filters, and micro-pool extended detention pond are all sized per AoT standards.

In portions of the site, where the above treatment devices cannot be constructed without significantly increasing the area of disturbance, increasing ponded runoff temperatures, are prohibited by Rule due to steepness, a treatment alternative has been incorporated into the design to focus on the potential pollutants of concern (sediment and temperature). Over 100 sediment traps have been strategically located to collect and store concentrated runoff and allow sediment particles to be settled and trapped. Because of the sediment trap sump, runoff trapped within the sump will be assimilated into the ground where it will cool and add to the local water table. During larger storms once the runoff fills the trap, the cleanest treated water within the trap (at the water surface) will disperse out of the trap onto the forest floor where leaf litter will further polish the water by trapping the fine particles, and thereby lessening the chance for turbid water to enter a stream or wetlands. These sediment traps have worked effectively at other locations with similar potential pollutants and site constraints and because of their dispersed nature they: can be efficiently sized to avoid additional tree clearing, are often shaded (reducing runoff temperature increases), are easily maintained, and help sustain local groundwater tables. These sediment traps effectively address the more limited range of anticipated pollutants when compared to other traditional forms of treatment, while avoiding the thermal impacts of expansive ponded treatment measures and thus provide a superior alternative that is equally or more protective of the environment.

Respectfully,

Art Colvin, P.E.
Project Manager
Horizons Engineering, Inc.

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Project No. 13185
November 21, 2013

NH Department of Environmental Services
Wetlands Bureau
29 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03302-0095

SUBJECT: NHDES Waiver Request – Iberdrola Renewables -Wild Meadows Wind Project

To Whom It May Concern;

Horizons Engineering, Inc. (Agent) is hereby submitting a waiver request on behalf of Atlantic Wind, LLC (Applicant) for the construction of a commercial wind powered electrical generation facility on the following lots located in Danbury and Alexandria, NH:

417-43	Ronald L & Donna J. Olszak
417-13	Stephen Garron & Paula Carter
417-8	Mike Corliss
414-144	Michael B. Oeschger
415-5	H. & H. INVESTMENTS, LLC.
403-25	H. & H. INVESTMENTS, LLC.
403-20	H. & H. INVESTMENTS, LLC.
403-19	H. & H. INVESTMENTS, LLC.
403-18	H. & H. INVESTMENTS, LLC.
401-1	H. & H. INVESTMENTS, LLC.
403-9	Monique Jome Ricker & Michelle Jome

The waiver request is being submitted pursuant to Env-Wq 1509.02. The rule to which we are requesting the waiver is Env-Wq 1504.09(b)(2)b.

Agent Information:
Art Colvin, P.E.
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Horizons Engineering, Inc.
34 School St.
Littleton, NH 03561
603-444-4111
acolvin@horizonsengineering.com

Applicant Information:
Erik Lallum
VP Engineering & Construction
Atlantic Wind LLC
1125 NW Couch Street, Suite 700
Portland, OR 97209
(503) 478-6361

This project proposes the construction of a number of roadways and wind turbine pads using coarse rock materials and cut and fill techniques that result in thick placement of materials over the underlying native soil/strata. These thicknesses and associated volume of voids in the placed material often trap much of the precipitation that falls on such materials and has a strong influence on the portion of rainfall that is converted to runoff. For example, where thick placement of this coarse material overlies a Hydrologic Group D soil (a soil that is highly impermeable) the natural runoff generating effect of the underlying D soil will not be realized because the coarse material and associated voids above it intercept and attenuate much or all of the precipitation. Although, for many surface covers, the Hydrologic Soil Group is an important determinant of Curve Number (CNs) selection; certain surfaces (such as asphalt) that provide a consistent impervious surface are not influenced by soil group. CNs for stone fill slopes or roadway material with appreciable voids are not available in most hydrologic models, and the effect of underlying soils can vary by material placement thickness, compaction, void area and particle arrangement. These factors will vary within the material placed on the project so the CNs chosen for this project are intended to be conservative in that they ignore the voids and trapping effect, in part because of this variability of voids and material thicknesses and surfacing within the project. Site Specific Soil Mapping is intended to provide greater resolution or differentiation between soil types and characteristics when compared to NRCS country wide soil surveys. One such characteristic is the hydrologic soil group, but where the influences of the underlying soil group are muted, due to material placement, the utility of such information may be quite low.

Forest is the overwhelming cover type within all analyzed watersheds and little of this will change within the project (for example drainage area 8 has the highest percentage of work proposed and converts less than 7 % of the drainage into another cover type (roads 1.4 %, grass/etc 5.4%)) and therefore, a large percentage of the watershed does not change. In small watersheds where a large percentage of the trees will be cut and soil covered by new surfaces, (including truly impervious surfaces) a change in the underlying soil group can have appreciable effects on the CN and associated change in runoff that is predicted. In these smaller watersheds it becomes more important to refine, by Site Specific Soil Mapping, the type of soil that will be either covered or resurfaced. It is for this reason the substation and operation and maintenance facilities have used Site Specific Soil Mapping for proposed development areas. In the remainder of the present project, where coarse roadway and pad materials will mute the permeable or impermeable nature of the underlying soils, and the project proposes to disturb a very small portion of a watershed, a refinement of NRCS soils to those that might be obtained through a greater resolution using Site Specific Soil mapping standards will unlikely yield an appreciable change in a composite CN. It is our opinion that the effort associated with collecting data that is unlikely to change the CN, and therefore, the need for additional mitigation measures doesn't provide a noticeable environmental benefit to the environment or the public that warrants the expenditure or effort.

Respectfully,

Art Colvin, P.E.
Project Manager
Horizons Engineering, Inc.

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